MRSA OTSA 84-01

OFF-THE-SHELF ANALYSES INFORMATION

GRAPHICAL REPAIR/DISCARD ANALYSIS PROCEDURE HANDBOOK

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ACKNOWLEDGMENTS

The US Army Materiel Command (AMC) Materiel Readiness Support Activity (MRSA) is responsible for planning and development of the GRAPH Off-TheShelf Analysis (OTSA) technique and for the preparation of this procedure handbook.

The MRSA development team for this effort consisted of the following personnel: Mr. John Peer, Coordinator; Mr. Leslie Adkins, Chief, Engineering Analysis Section; Mr. Ellis Atkinson, Team Chief; Ms. Theresa Barker, Engineering Technical Advisor; and Ms. Connie Popp, ADP Technical Assistant.

DISCLAIMER

This Off-The-Shelf Analysis (OTSA) technique was developed by USAMC MRSA to support Level Of Repair Analysis (LORA) efforts in the development community. The contents of this handbook represent the views and conclusions of the Commander, MRSA, and do not necessarily reflect the official views of the Department of the Army or HQ AMC. MRSA is prepared to discuss all issues and assumptions of this technique at the discretion of HQ AMC or the requesting agency/activity.

INTRODUCTION

Level of Repair Analysis (LORA) is a process used to assist in the determination of the most economical maintenance policy for an item of equipment. The requirement for LORA is established by MIL-STD-1388-1A, subtask 303.2.7.

It is important to perform a LORA as early as possible in the aquisition process. The opportunity to affect design diminishes rapidly as the process continues. Maintainability features should be incorporated into reparable equipment before the design is firmly established.

There are many models available within the government and industry which are designed to perform LORA. Many of these are large, cumbersome models which require varying degrees of training and substantial ADP facilities. These requirements are imposed due to the numerous logistic considerations involved in modeling a complete support system. The preponderance of models to be used to perform LORA, however, has recently been reduced in an effort toward standarization. Those models recommended as a result of an interim AMC policy letter (28 AUG 83) are LOGAM, OSAMM, NRLA, MIL-STD-1390B, KASIAN TPS, PALMAN, IRLA, and MICOM ORLA.

This technique, designed as a user friendly OTSA methodology, was developed to aid in early repair/discard analysis. It was designed for ease of application to encourage its use and, thereby, reduce costs and improve readiness of Army systems.

Repair versus discard is an element of LORA. Before deciding how to repair an item it is necessary to decide whether or not it is worth repairing. One way of making this decision is to examine the cost difference between repairing the item and discarding it. The technique contained in this manual was developed in this manner by use of the Interactive PALMAN Model (IPM).

APPLICATION

The first point of application for the GRAPH technique is during the concept phase as a means of performing comparative analyses and system tradeoff analyses. Application at this point is highly speculative and/or limited to smaller systems.

The next point of application for the GRAPH technique is during the D&V phase of the life cycle, concurrent with hardware design and prior to DT/OT 1. Early application allows an opportunity to affect design and incorporate desirable maintainability features. The technique should be reiterated during each of the later phases as often as necessary to assure optimum maintenance planning and designed in maintainability.

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1.

During field visits and/or contractor site visits a lack of ADP facilities may be encountered. There may also exist a shortage of ADP personnel and/or expertise in logistics modeling. In such cases the GRAPH technique will allow quick and easy decsions on repair vs. discard.

Other or more sophisticated models will be required to perform LORA on end items and major system components. GRAPH is intended to complement these models to further optimize the repair policy for lower level assemblies.

LIMITATIONS

The application of this technique is limited by the scale of the graphs shown in Appendix A. The range of values on the scales were selected to allow a reasonable degree of accuracy. The scale which represents the cost of repair parts (COSTRP) is limited to values between $100 and $1000. Values beyond these limits cannot be extrapolated by extending the curve on these scales. The other two scales may be extended to allow extrapolation outside the range on the graph. These features are due to the manner in which the nomographs were constructed.

The graphs will allow the user to obtain breakeven costs with less than 10% error, compared to mathematical techniques, when reasonable care is exercised in using the graphs. In the event that the assembly cost is within 10% of the breakeven cost the repair/discard decision should not be based solely on this analysis. Other criteria should be considered such as, readiness, availability of personnel, and availability of parts.

In order to produce the nomographs for this technique certain assumptions were made regarding the value of logistic parameters. These assumptions are discussed in appendix B.

DATA REQUIREMENTS

The following is a list of the data elements necessary to use the technique set forth in this manual. In the remaining sections of this manual these data elements will be referenced by the variable names associated with each element. They are listed here in the order in which they will be needed to perform this analysis.

VARIABLE NAME	DESCRIPTION
FAILUR	Total number of failures an assembly will experience in one million hours of operation.
Q	Total number of this particular assembly in each end item.
EN	Total number of end items deployed.
FRACOP	Fraction of real time deployed equipment operates (i.e., equipment operates two (2) hours/day for 7 days/week, FRACOP=.083)
YEARS	Number of years equipment is expected to be in inventory.
COSTLH	Cost per labor hour. This variable may have only two values; COSTLH = $15.00 and COSTLH = $30.00 which are meant to model forward and depot repair respectively.
REPNOT	Fraction of assemblies on which repair is attempted but is not successful. If no data is available, assume REPNOT = .05.
REPHRS	Mean repair time per failed assembly.
COSTRP	Cost of repair parts per repair.
COSTFD *	Development cost for test equipment and facilities. May include any capital expenditure.
COSTFP *	Procurement cost for test equipment and facilities.

* These elements will not apply to every case. They will be required only when test equipment and facilities required for repair must be developed and/or procured.

PROCEDURE

This procedure is used to determine the breakeven cost between repair and discard of an assembly. Once the breakeven cost is determined the user may make one of three decisions; repair the assembly, discard the assembly, or conduct further analysis.

The criteria for the decision are simple. If the actual cost of the assembly is greater than the breakeven cost the assembly should be repaired. If the assembly cost is less than the breakeven cost the assembly should be discarded. If the assembly cost is within 10 percent of the breakeven cost other criteria should be used to make the repair/discard decision. Other criteria includes, but is not limited to, availability of personnel to perform repairs, availability of training for test and repair personnel, availability of repair parts to make repairs, and the burden that each alternative will place on the supply and transportation systems.

A data gathering work sheet is provided on page 7 and an example problem is provided on page 9.

STEP 1

Objective: Calculate the total number of failures that will occur during the life of the system in which the assembly is employed.

Procedure: The following formula is used to calculate total failures.

Total Failures = .00876 * FAILUR * Q * EN * FRACOP * YEARS + (.1 * .00876 * FAILUR * Q * EN * (1-FRACOP) * YEARS)

WHERE:

FAILUR = Expected number of failures of an assembly per million hours of constant operation.

Q = Total number of this particular assembly per end item.

EN = Number of end items to be fielded.

FRACOP = Fraction of calender time that the assembly is operated.

YEARS = Length of time in years that the end item is expected to be in inventory.

.00876 = Number of million hours per year.

.1 = represents the assumption that there exist a failure rate during non operating hours that is 1/10th that of the operating failure rate

STEP 2

Objective: Determine which chart is needed for a particular applicaton.

Procedure: Refer to figure 1 on page 11. Starting at the top of the chart, choose the cost per labor hour (COSTLH) figure which best fits your application. COSTLH = $15.00 is intended to model forward repair whereas COSTLH = $30.00 is intended for depot repair. After choosing the appropriate value for COSTLH, go to the next echelon (REPNOT) under COSTLH. REPNOT is the percentage of assemblies on which repair is attempted but is unsuccessful. Choose the appropriate value for REPNOT and look in the column below that value for the REPHRS which is closest to the case question. The chart needed for this application is on the page indicated next to the REPHRS value.

Example: Suppose we wish to consider forward repair (COSTLH = $15.00), a repair rate of 95 percent (REPNOT = .05), and a mean repair time of two (2) hours (REPHRS = 2.00). The chart need for this case is number 44.

STEP 3

Objective: Determine breakeven cost.

Procedure: After the appropriate chart has been selected, it is necessary to estimate the average cost of repair parts per repair (COSTRP). Cost data may be obtained from the contractor, or from baseline data, or from expert knowledge. Enter the chart on the COSTRP scale and locate the value of COSTRP. Draw a line from this point to the point on the TFAILS line which represents the total failures calculated in STEP 1. The point of intersection between this line and BREAKEVEN line is the breakeven cost between repair and discard.

IMPORTANT: The breakeven cost obtained above does not include cost for development and procurement of test equipment and facilities for assembly repair. If these costs exist, proceed to STEP 4.

STEP 4

Objective: Increase breakeven cost to account for development and/or procurement cost.

Procedure: If cost for development and/or procurement of test equipment and facilities is incurred it will be neccessary to add to the breakeven cost. To figure the dollar amount to add,

consult the set of curves on page 12. For convience this graph is reproduced in the upper right hand corner of each chart. There are two curves on this graph. The upper curve represents the add on cost for procurement of test equipment and facilities per $5,000 of procurement cost. The lower curve is the add on cost for development of test equipment and facilities. To use the graph locate the total failures, calculated in STEP 1, on the vertical axis. Move horizontally until an intersection is made with the appropriate curve. Now, project this point to the horizontal axis and read off the dollar value per $5,000 of development or procurement cost to be added to the breakeven cost before making the repair/discard decision.

Once this value for development and/or procurement cost per $5000 has been taken from the graph, the following procedure can be used to find the total add on cost for development (COSTFD) or procurement (COSTFP).

COSTFD/$5000 (or COSTFP/$5000)	_____
multiplied by "add on" cost for COSTFD (or COSTFP) per $5000--from graph	* _____
add on cost for COSTFD (or COSTFP)	= _____

Procurement costs for particular pieces of existing test equipment may be obtained through PM TMDE or CTA. Estimates of development and procurement of new test equipment must be made by comparison to existing equipment, experience, or contractor estimate. DESCOM can provide estimates for facilities cost.

The development cost curve (lower curve) may also be used to account for any other capital expenditures which are not covered by the cost elements described in appendix B.

DATA GATHERING WORKSHEET

ASSEMBLY NAME: _____

The first group of data is required immediately to calculate total failures in STEP 1.

1. FAILUR = _____
2. Q = _____
3. EN = _____
4. FRACOP = _____
5. YEARS = _____ TFAILS = _____

The next three data elements are used in STEP 2 to determine which graph must be used. This determination will be made by applying these variables to figure 1 on page 11.

6. COSTLH = _____
7. REPNOT = _____
8. REPHRS = _____ GRAPH NUMBER = _____

The next variable is used in conjuction with TFAILS (calculated in STEP 1) to determine breakeven cost in STEP 3.

9. COSTRP = _____ Breakeven Cost = _____

The last two variables are needed only when there are development and/or procurement costs for test equipment and facilities associated with the assembly under consideration. Values obtained from the appropriate graphs (see STEP 4) will be added to the breakeven cost.

10. COSTFD = _____ add on for COSTFD = _____
11. COSTFP = _____ plus add on for COSTFP = + _____

Total add on = _____

plus Initial Breakeven Cost = + _____

Breakeven Cost = _____

Now the repair/discard decision can be made by comparing the assembly cost to the breakeven cost.

ASSEMBLY COST =_____ BREAKEVEN COST =_____

If the assembly cost is greater than the breakeven cost, the assembly should be repaired.

If the assembly cost is less than the breakeven cost,the assembly should be discarded.

If the assembly cost is within 10% of the breakeven cost, the decision to repair or discard should not be based solely on this analysis.

EXAMPLE PROBLEM

System X is an Army weapon system. On board BITE can fault isolate a failure down to the azimuth positioner (AP) on the fire control unit. We wish to study the AP to determine whether it should be repaired or discarded.

The AP consists of 4 circuit cards and a gyro assembly as shown in table 1.

TABLE 1

AZIMUTH POSITIONER PARTS

PARTS	COST	FAILURES/MILLION HRS	%CONTRIBUTION	
CARD 1	$150.00	2	2/16	18.75
CARD 2	$275.00	2	2/16	34.37
CARD 3	$200.00	1	1/16	12.50
CARD 4	$900.00	8	8/16	450.00
GYRO	$750.00	3	3/16	140.63

COST OF REPAIR PARTS PER REPAIR = 656.24

A replacement assembly costs $2300.00.

Specifications:

The AP is expected to be deployed in system X, which has a density of 800, for ten years. There is only one AP in each system. The AP experiences 16 failures per million hours of operation and is expected to operate 10 hours per day, seven days per week.

Procedure:

From the specifications above, transfer the appropiate data to the data collection worksheet.

1. FAILURE = 16 Failures per million hours.
2. Q = 1 Assemblies per end item.
3. EN = 800 Number of end items.
4. FRACOP = .417 Fraction of operating time.
5. YEARS = 10 Deployment years. TFAILS = 533

TOTAL FAILURES = .00876 x 16 x .417 x 800 x 10
+(.1 x .00876 x 16 x 1 x 800 x .583 x 10) = 532.94

Since this analysis is being performed for depot level repair the cost per labor is $30.00. Experience says that 10% of the repair actions will be unsuccessful. The mean time to repair the AP is 1/2 hour.

6. COSTLH = $30.00 Cost per labor hour.
7. REPNOT = 0.10 Unsuccessful repair attempts.
8. REPHRS = 0.50 Mean Time To Repair.

Using these figures and referring to the tree diagram, it is determined that graph number 74 is needed for this case.

GRAPH NUMBER 74

Table 1 shows the average cost of repair parts per repair is $656.24.

9. COSTRP = $656

Using graph number 74 draw a line from the point where COSTRP = 656 to the point where TFAILS = 533. Read the breakeven cost from the point where this line intersects the axis labeled BREAKEVEN COST. Enter this value on the data gathering worksheet.

BREAKEVEN COST $3510

Repair of the AP will require procurement of existing test equipment totaling $50,000. The adjustment graph shows that for 533 failures it is necessary to add approximately $23.00 to the breakeven cost for each $5000 of procurement cost.

50,000/5000 = 10 -------> 10 x 23.00 = $230.00

BREAKEVEN COST $3510
ADD ON +$ 230

BREAKEVEN COST $3740

Decision:

Since the breakeven cost is higher than the assembly cost ($2300) the AP should be discarded.

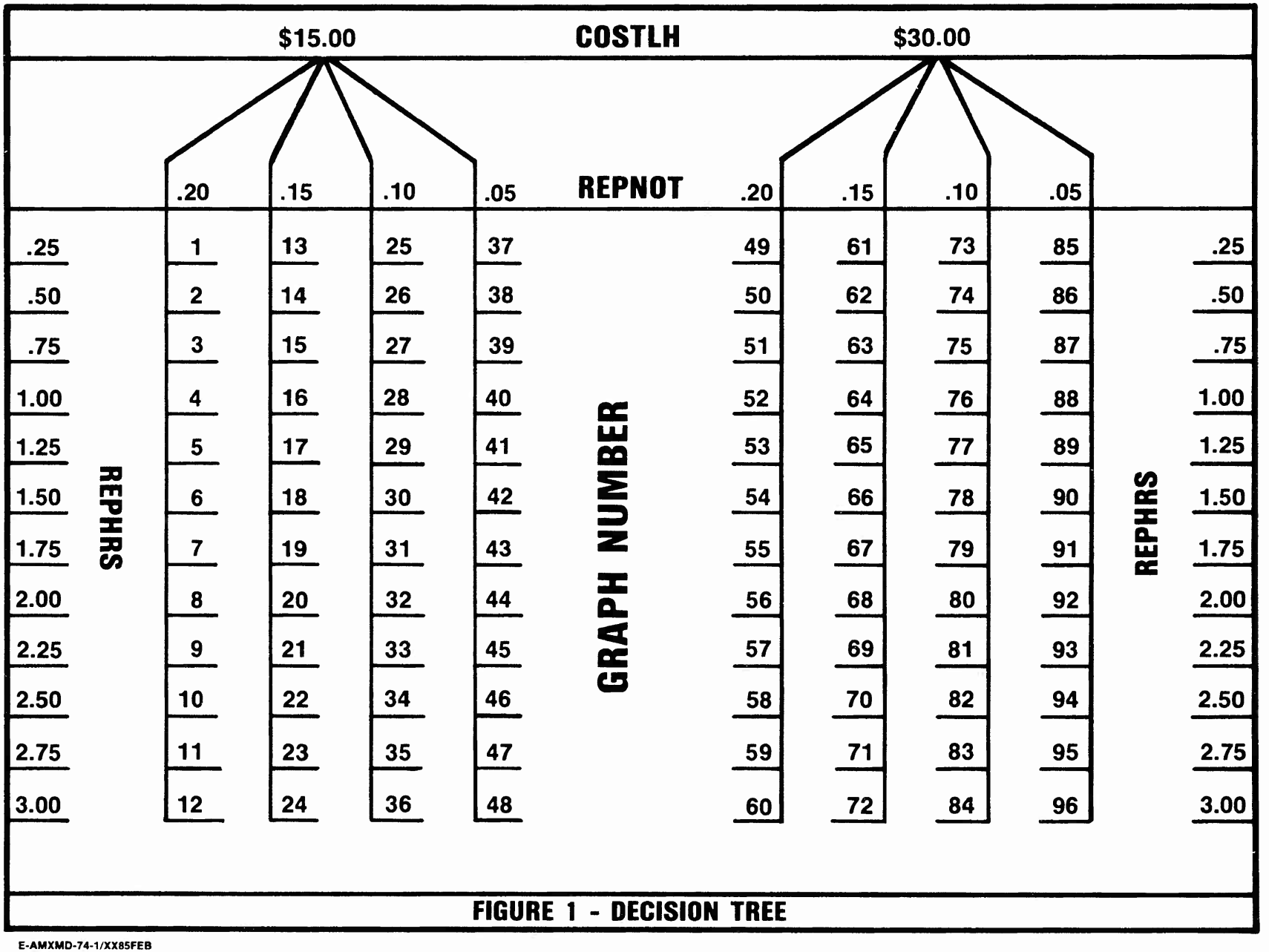
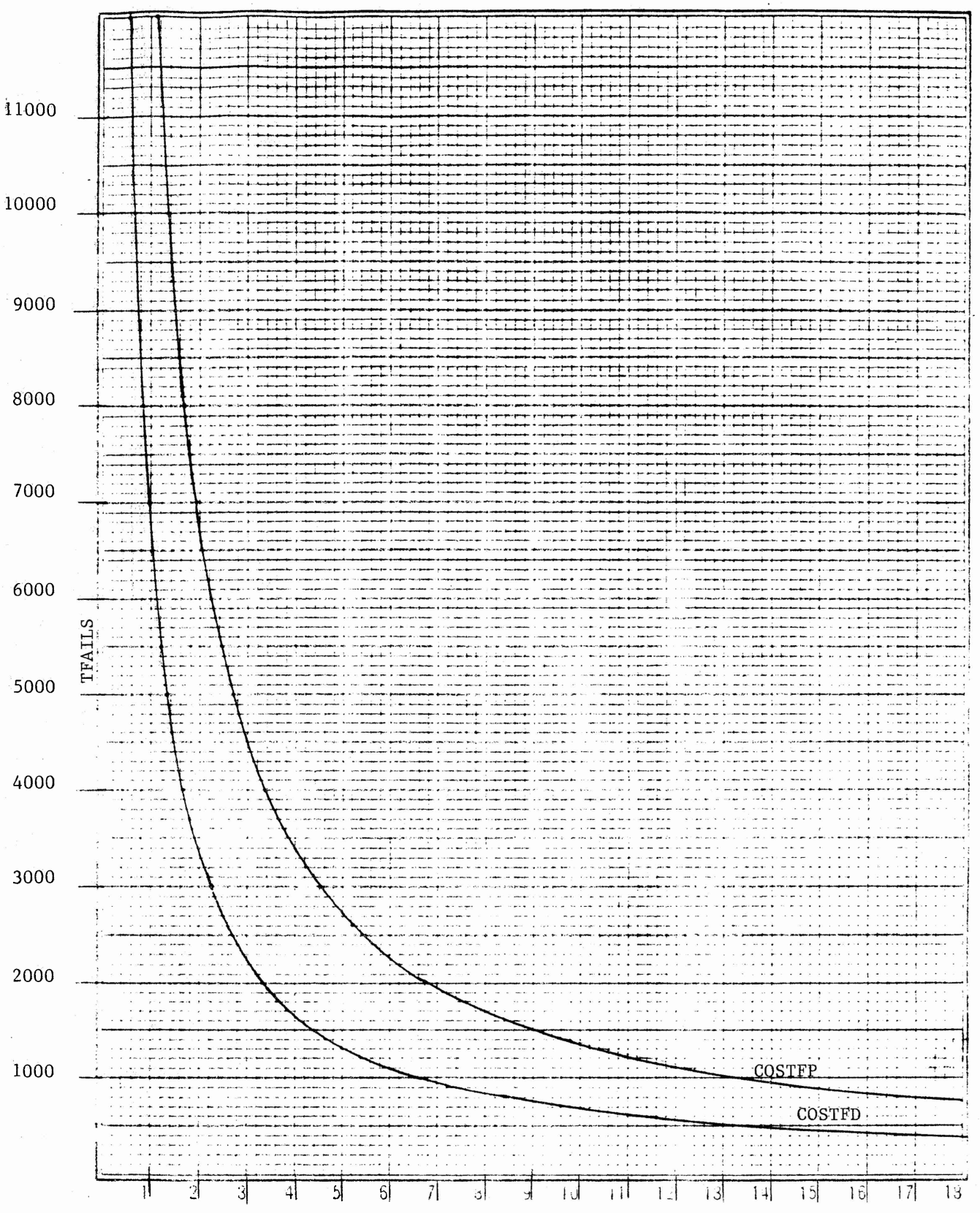


FIGURE 1 - DECISION TREE

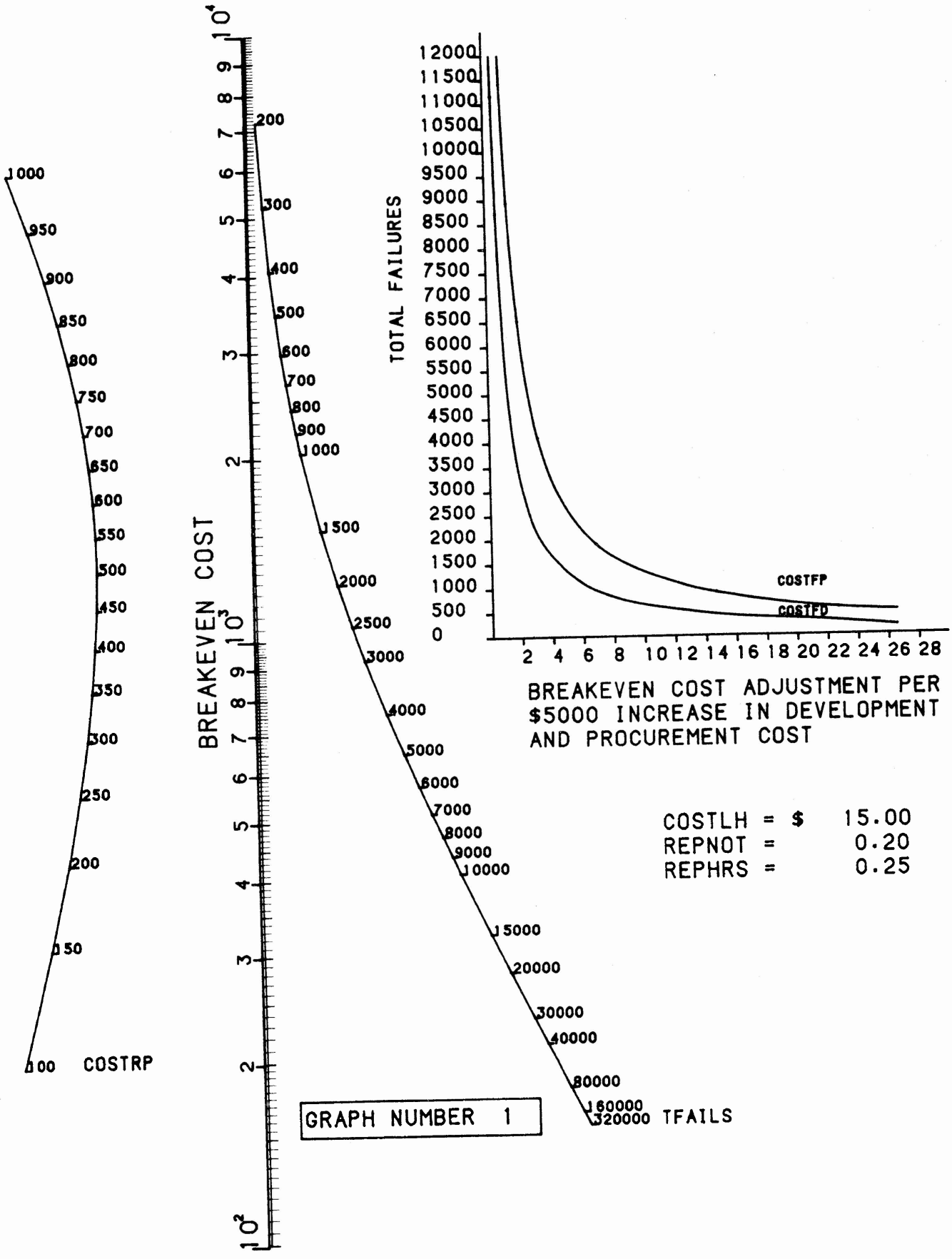
E-AMXMD-74-1/XX85FEB

FIGURE 2.
DEVELOPMENT/PROCUREMENT COST
GRAPH



APPENDIX A

NOMOGRAPHS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COSTRP
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TFAILS
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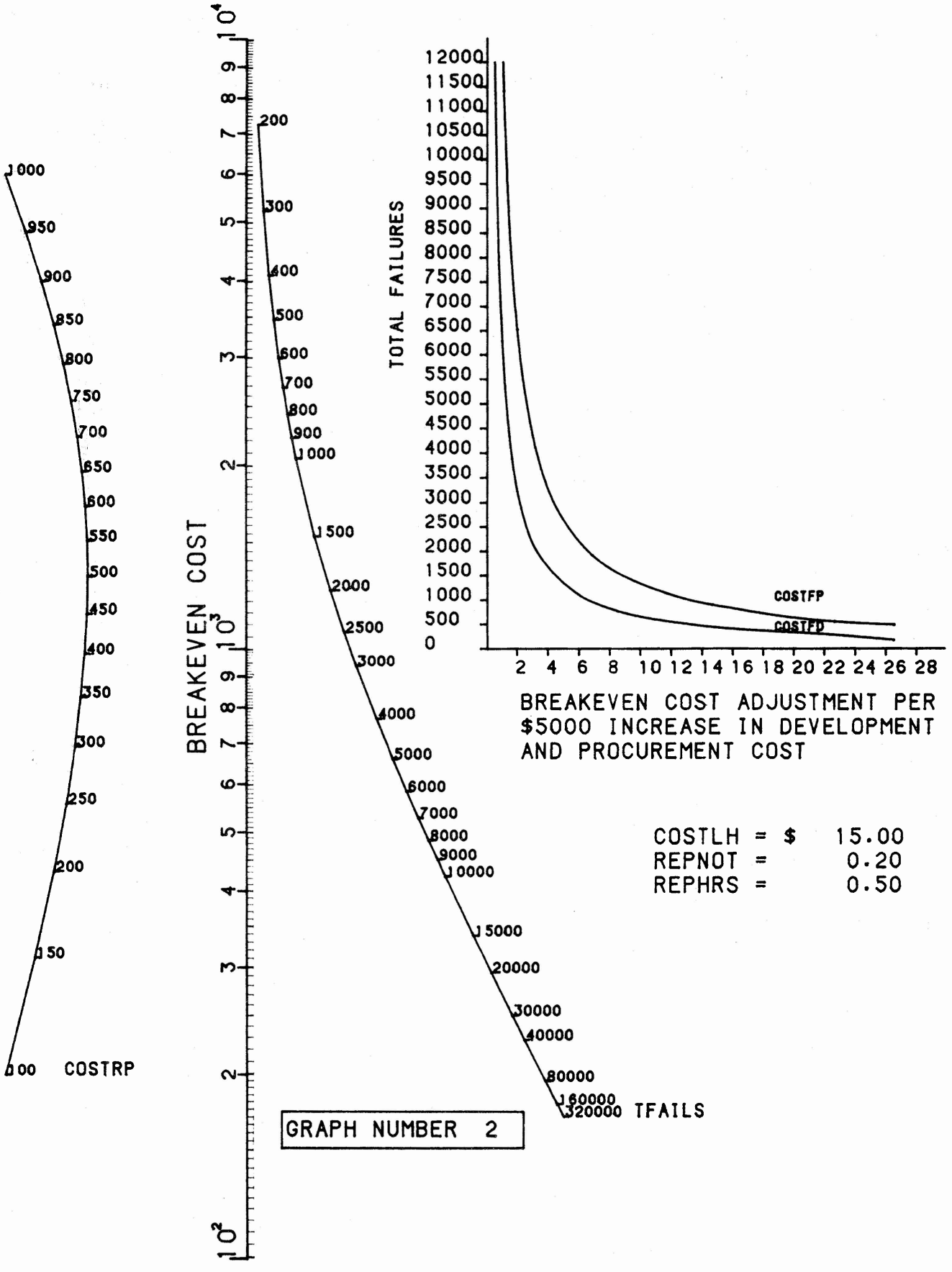
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.20
REPHRS = 0.25
GRAPH NUMBER 1


BREAKEVEN COST
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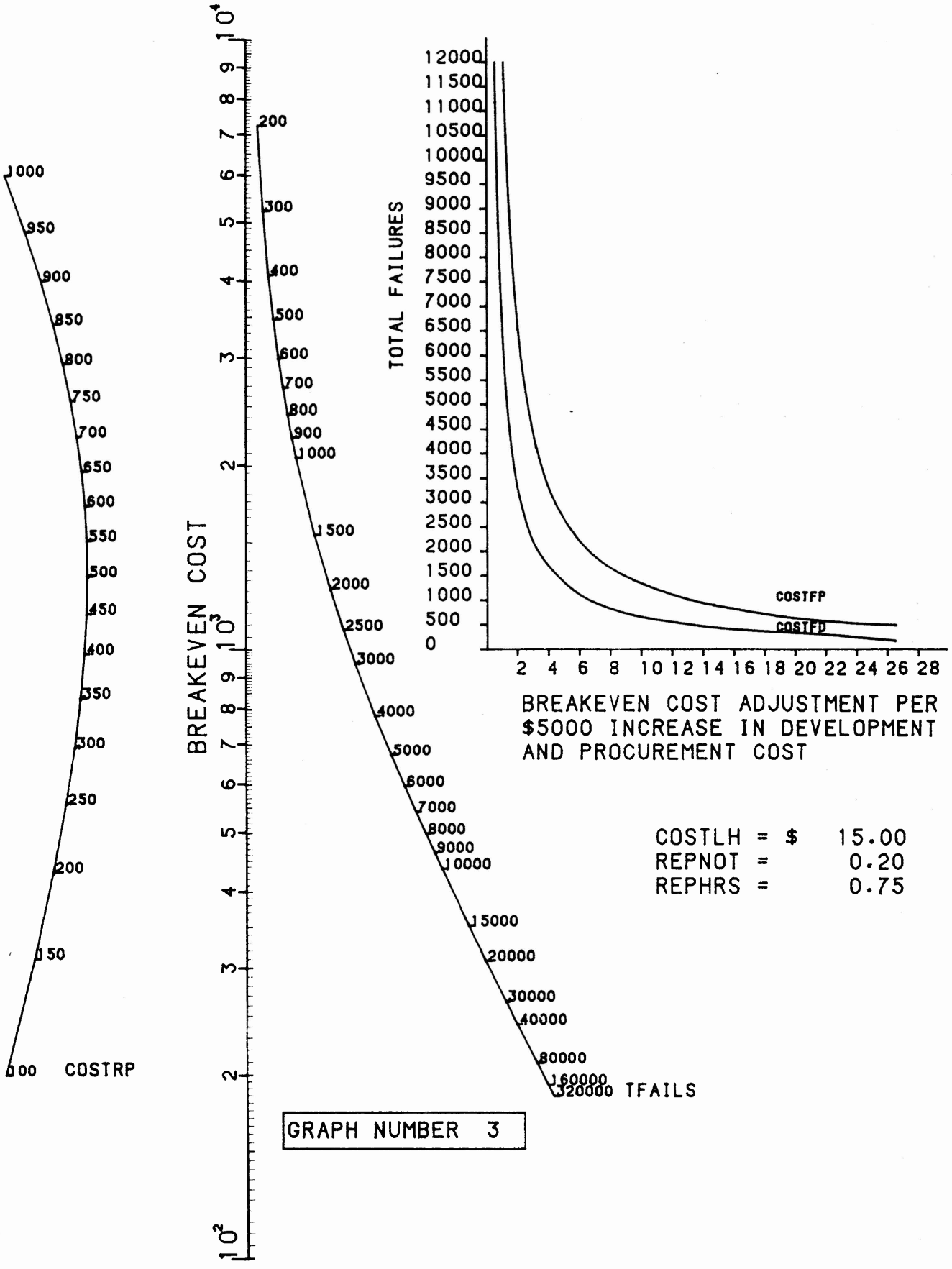
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.20
REPHRS = 0.50
COSTRP
TFAILS
GRAPH NUMBER 2


BREAKEVEN COST
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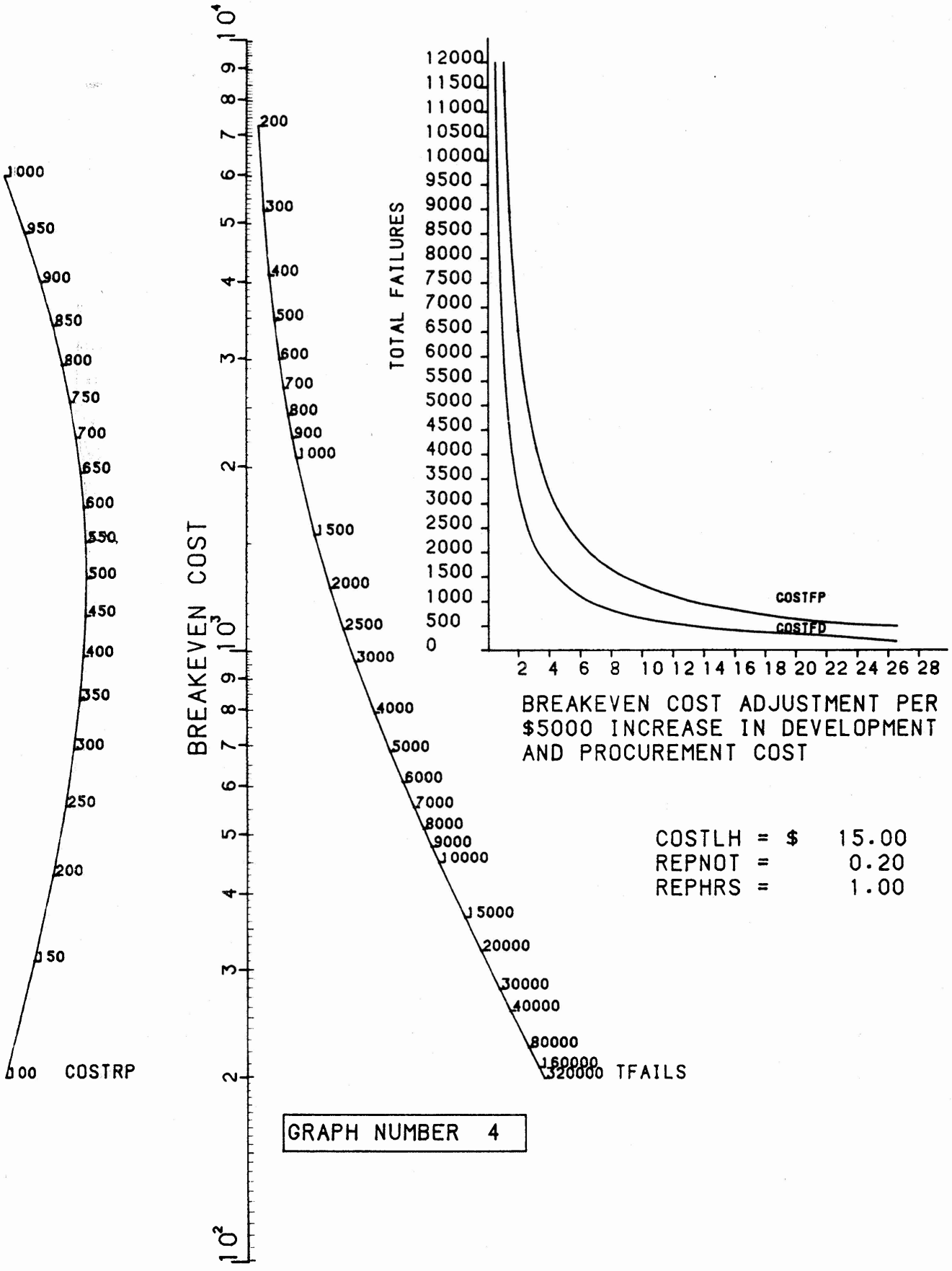
REPHRS = 0.75
GRAPH NUMBER 3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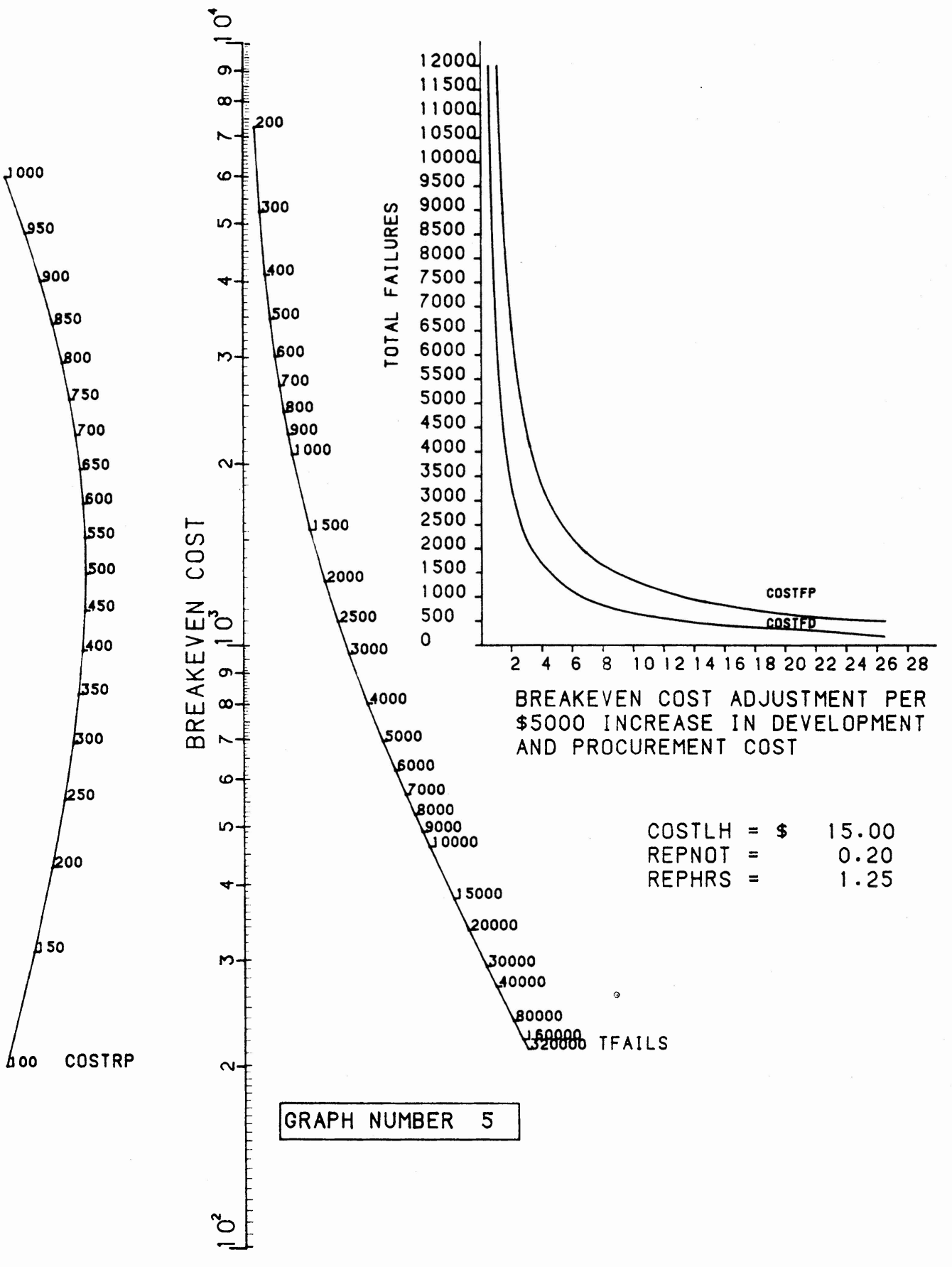
REPHRS = 1.00
GRAPH NUMBER 4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BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
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REPHRS = 1.25
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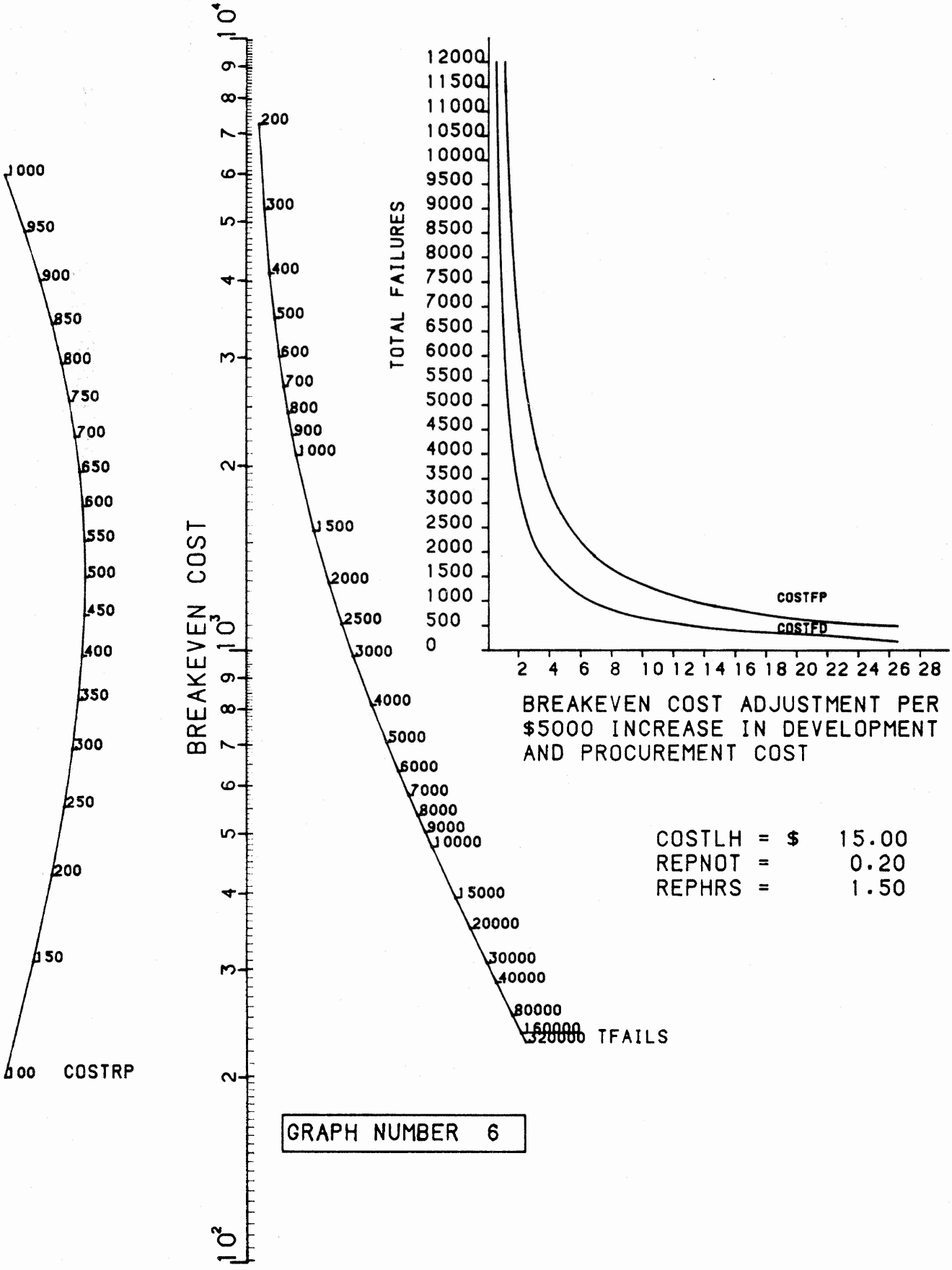
BREAKEVEN COST
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BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
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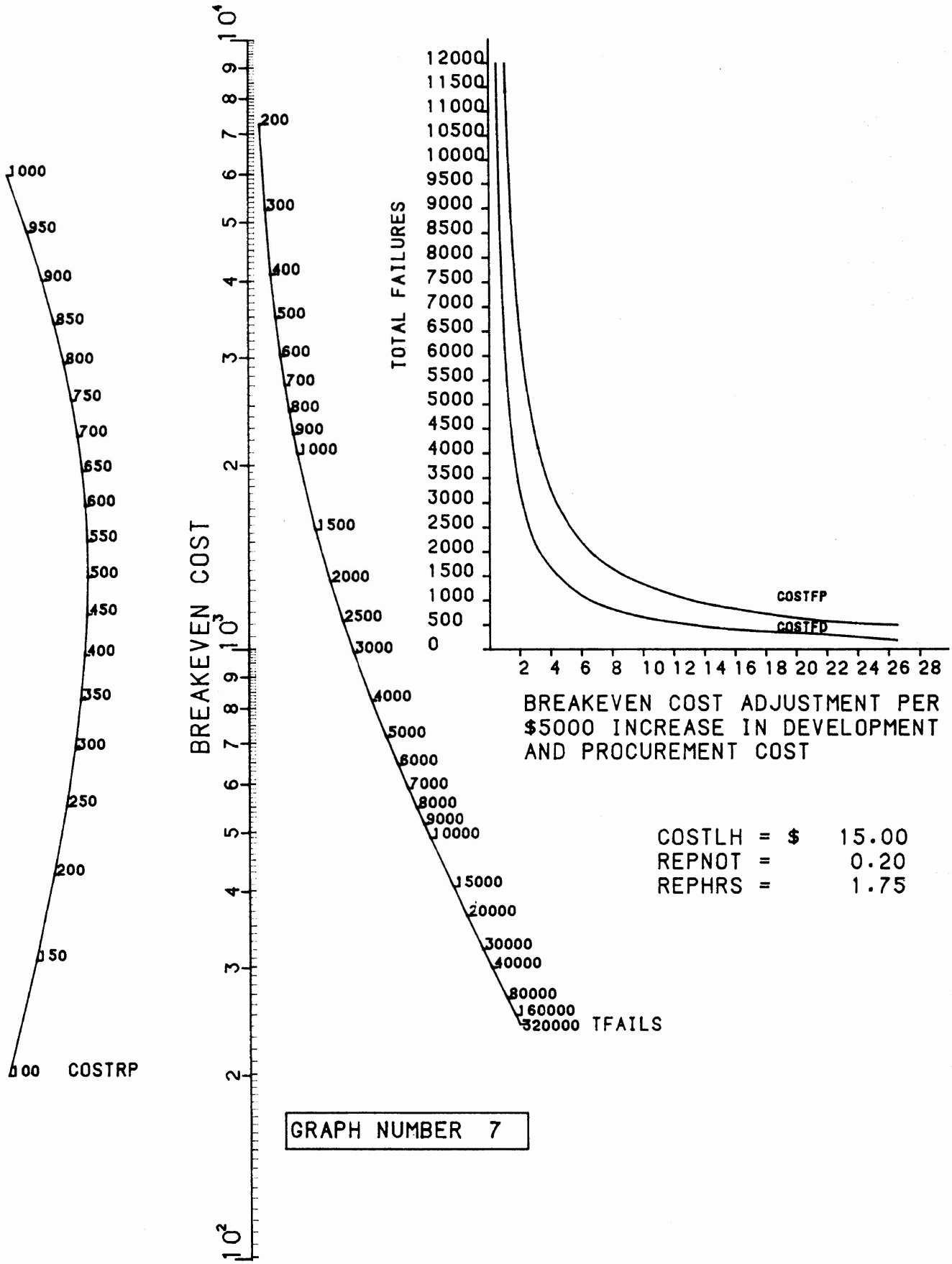
REPNOT = 0.20
REPHRS = 1.50
COSTRP
TFAILS
GRAPH NUMBER 6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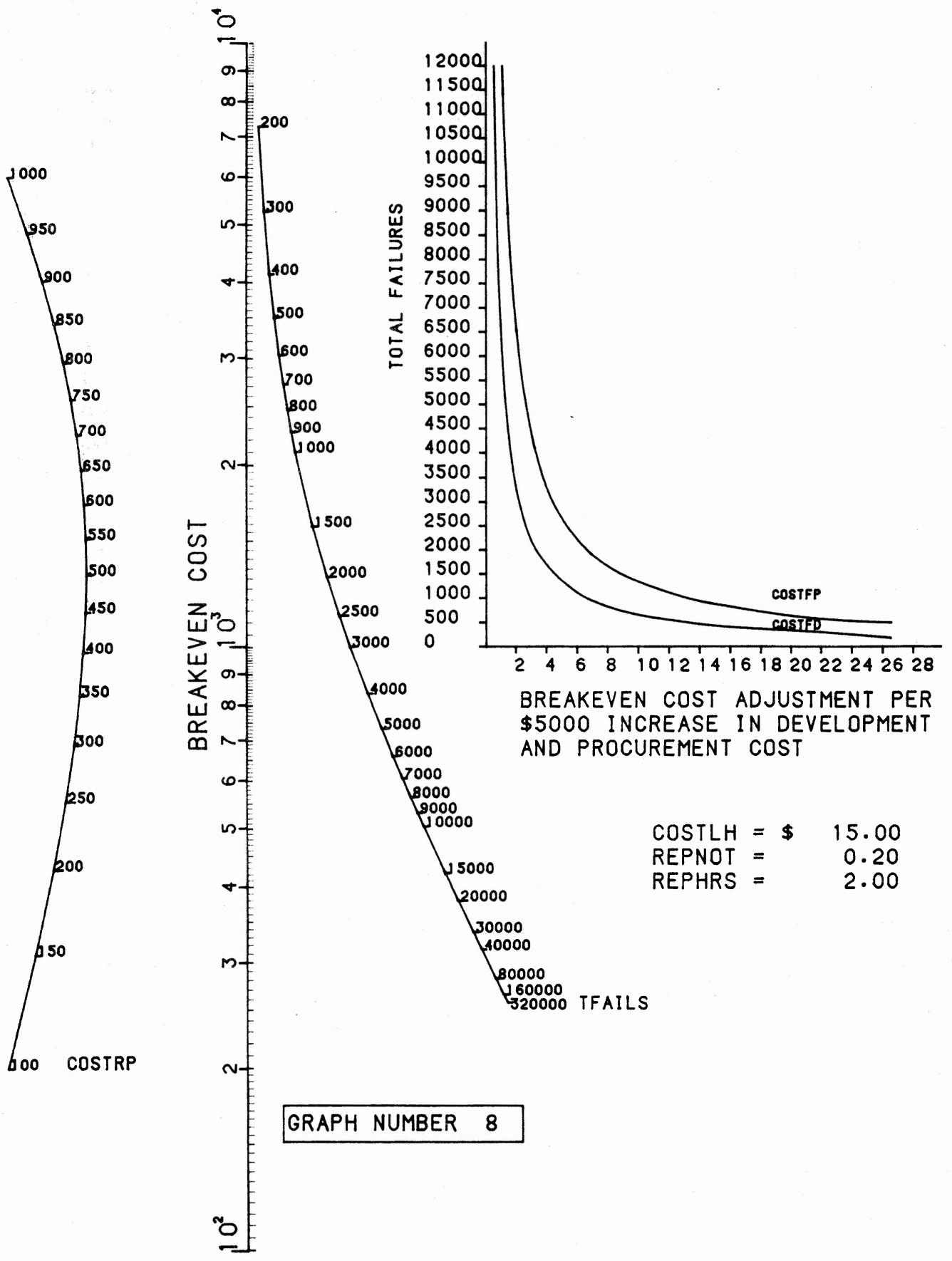
GRAPH NUMBER 7


BREAKEVEN COST
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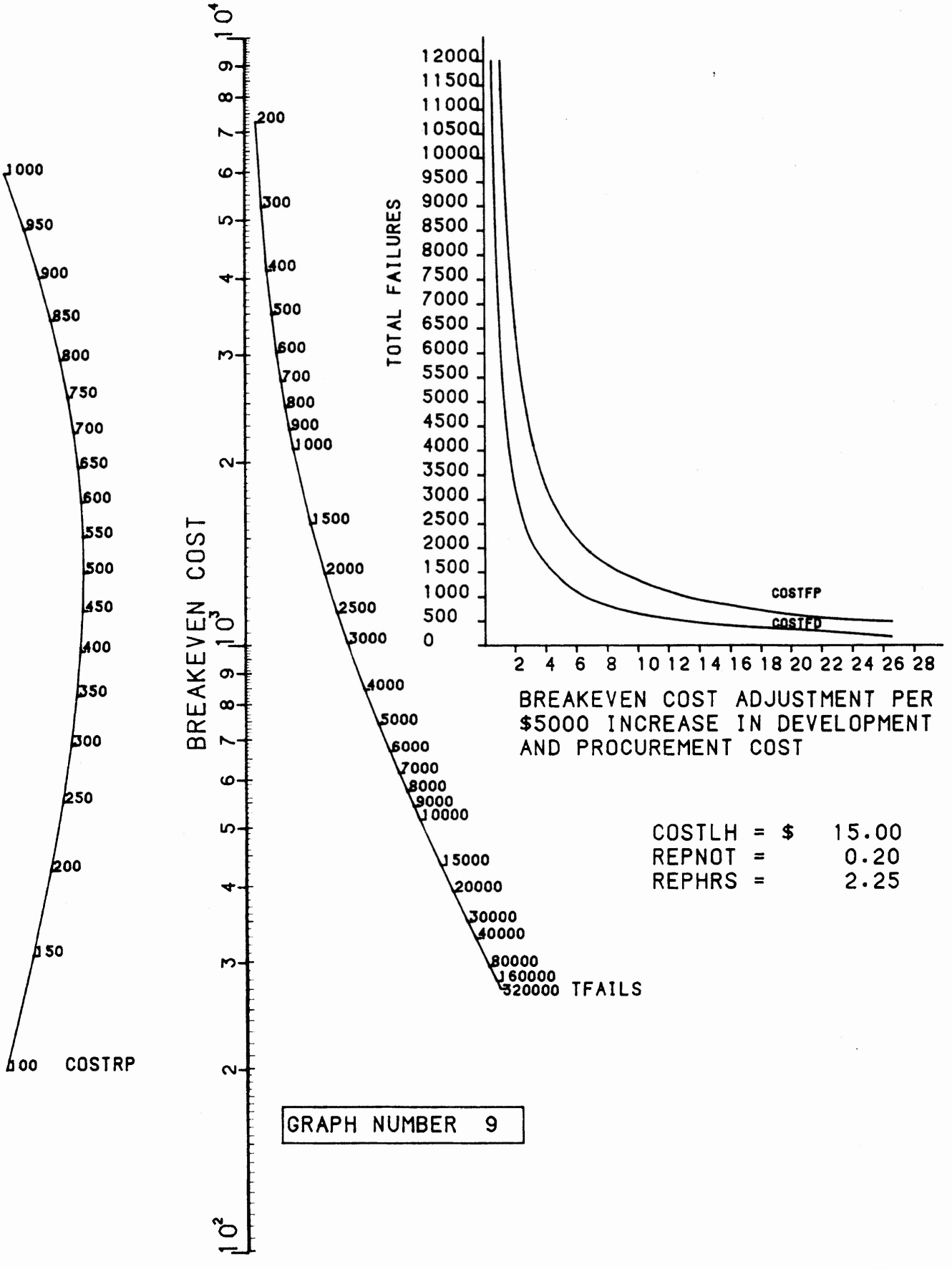
GRAPH NUMBER 8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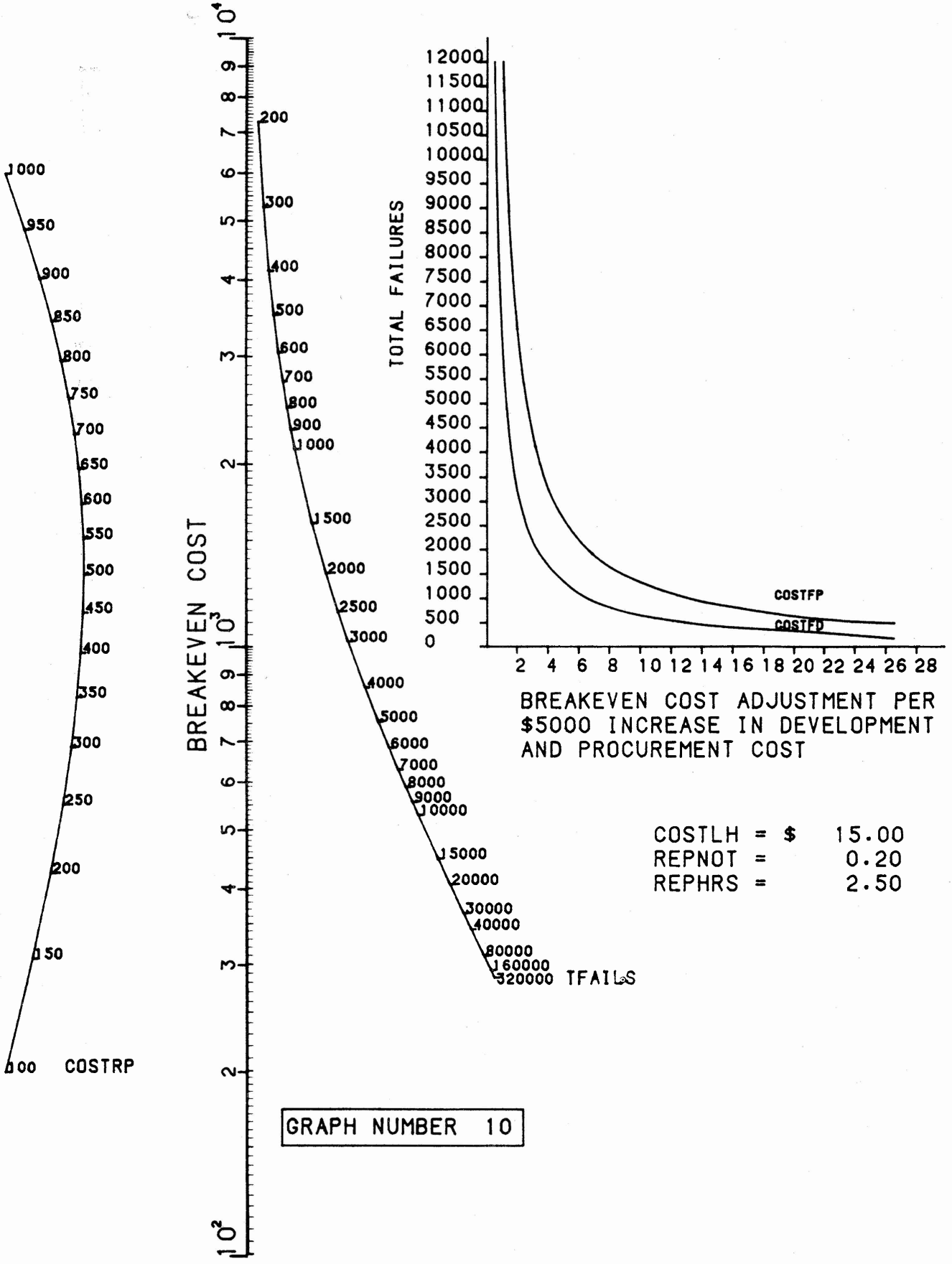
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.20
REPHRS = 2.25
GRAPH NUMBER 9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COSTFP
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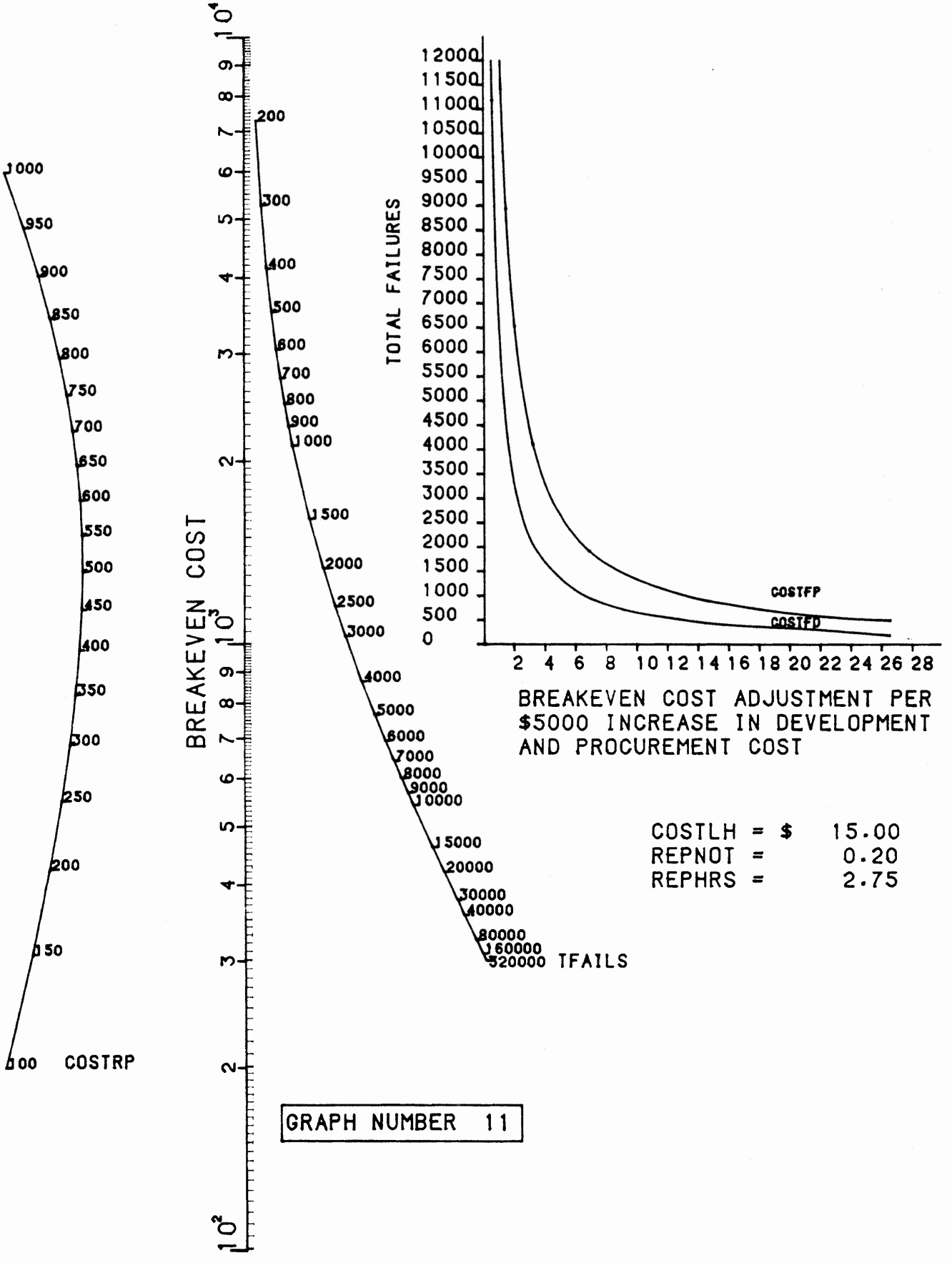
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.20
REPHRS = 2.50
GRAPH NUMBER 10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COSTFP
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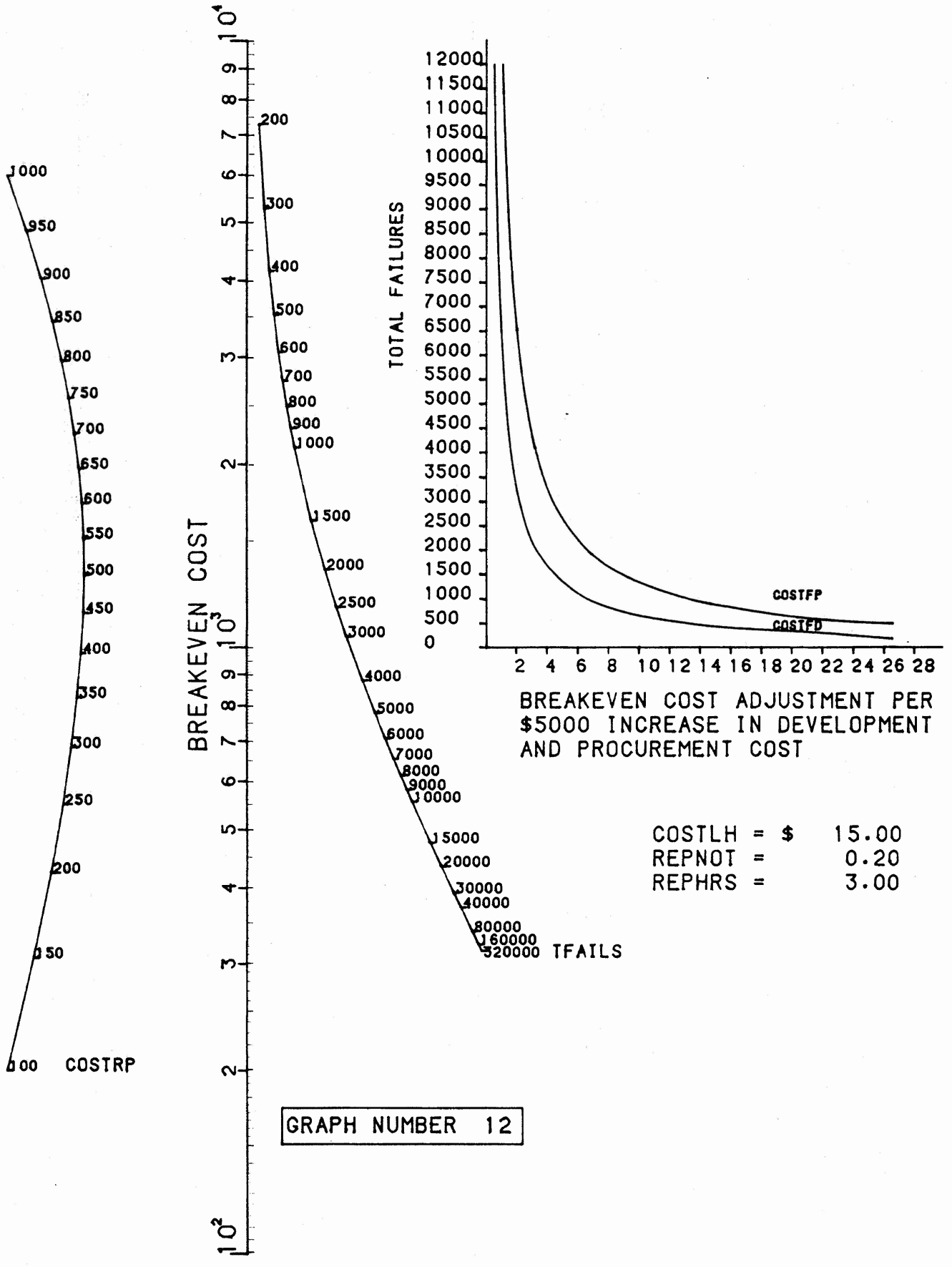
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.20
REPHRS = 2.75
GRAPH NUMBER 11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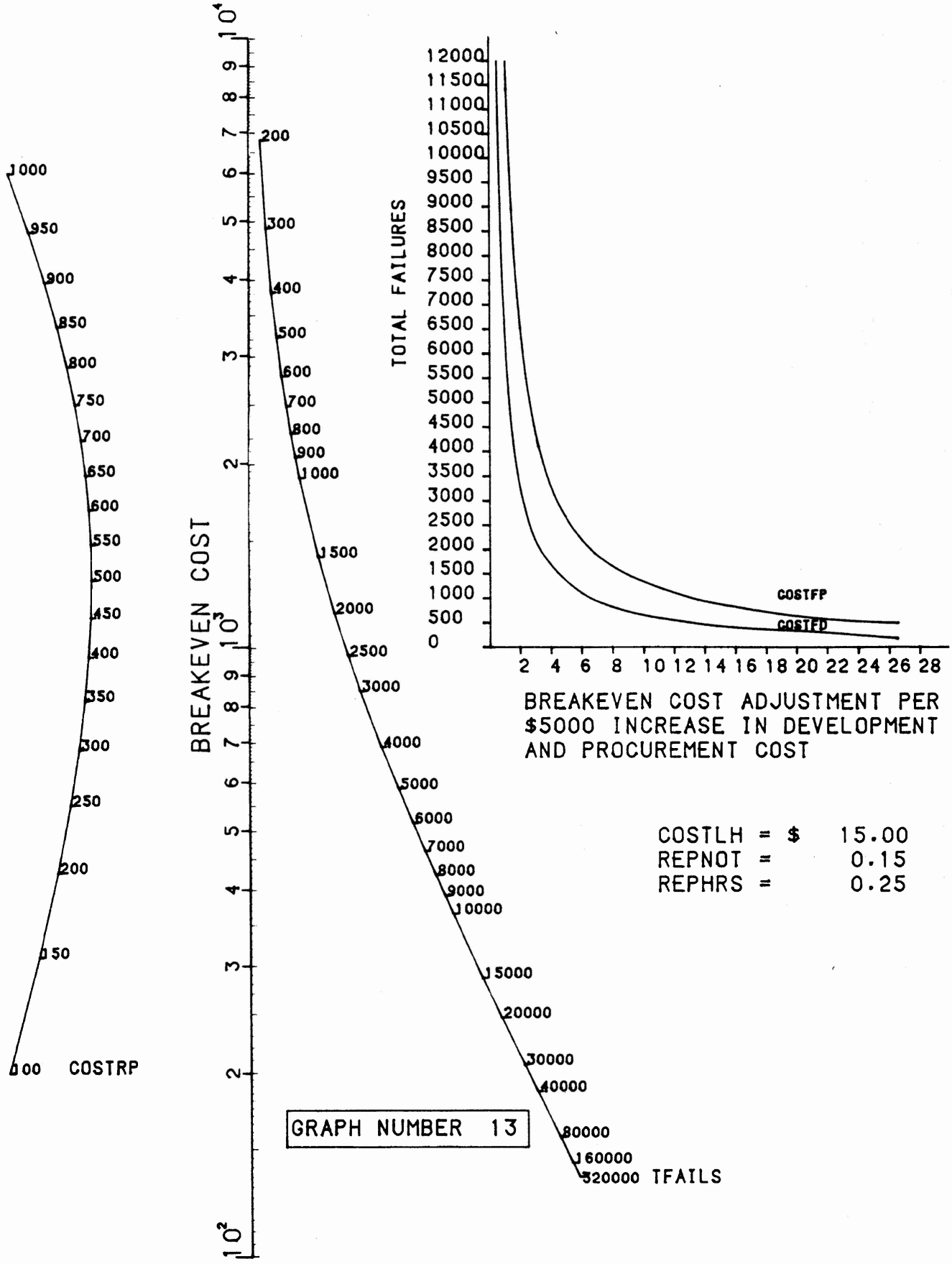
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.20
REPHRS = 3.00
GRAPH NUMBER 12


BREAKEVEN COST
TOTAL FAILURES
COSTFP
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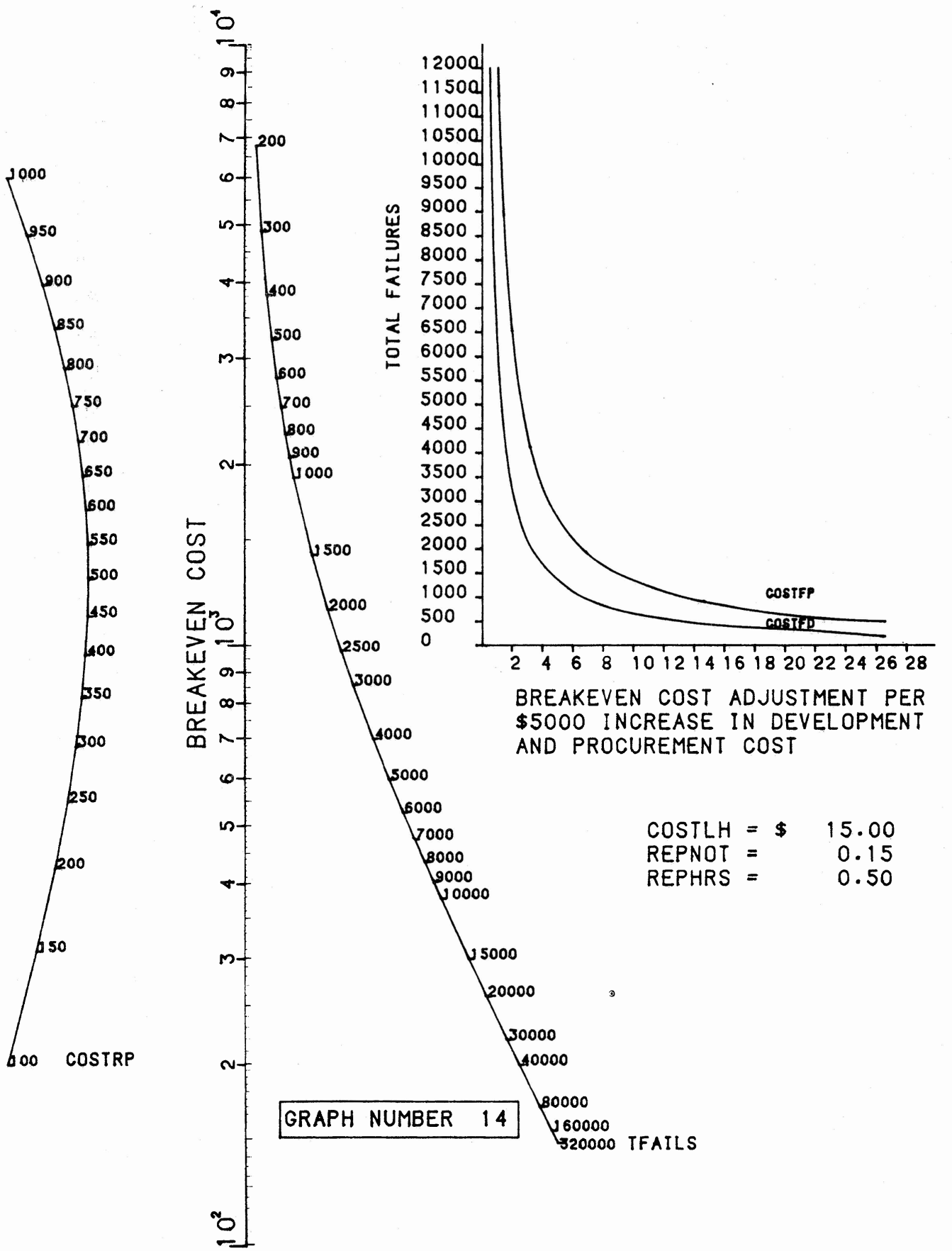
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.15
REPHRS = 0.25
COSTRP
TFAILS
GRAPH NUMBER 13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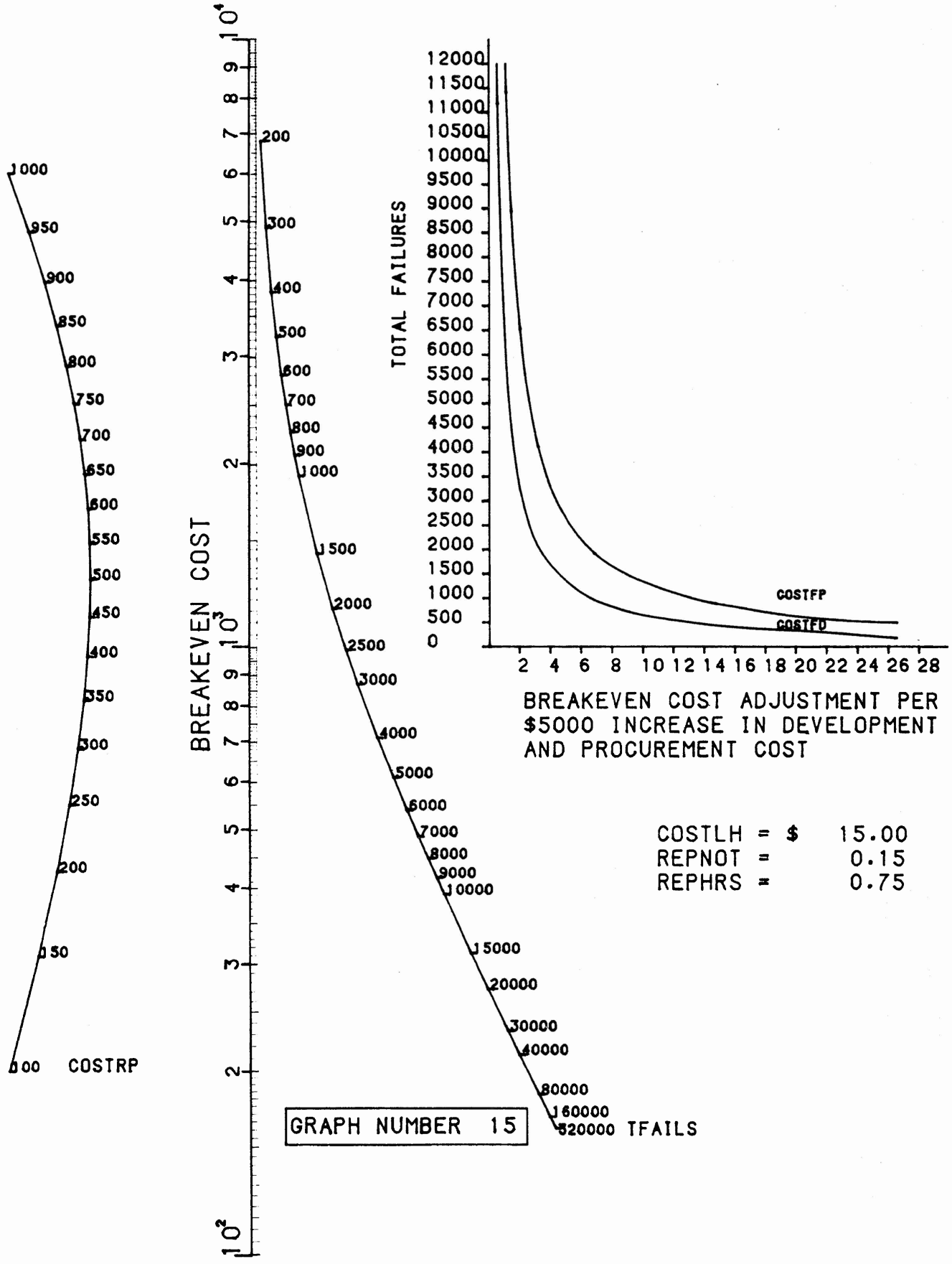
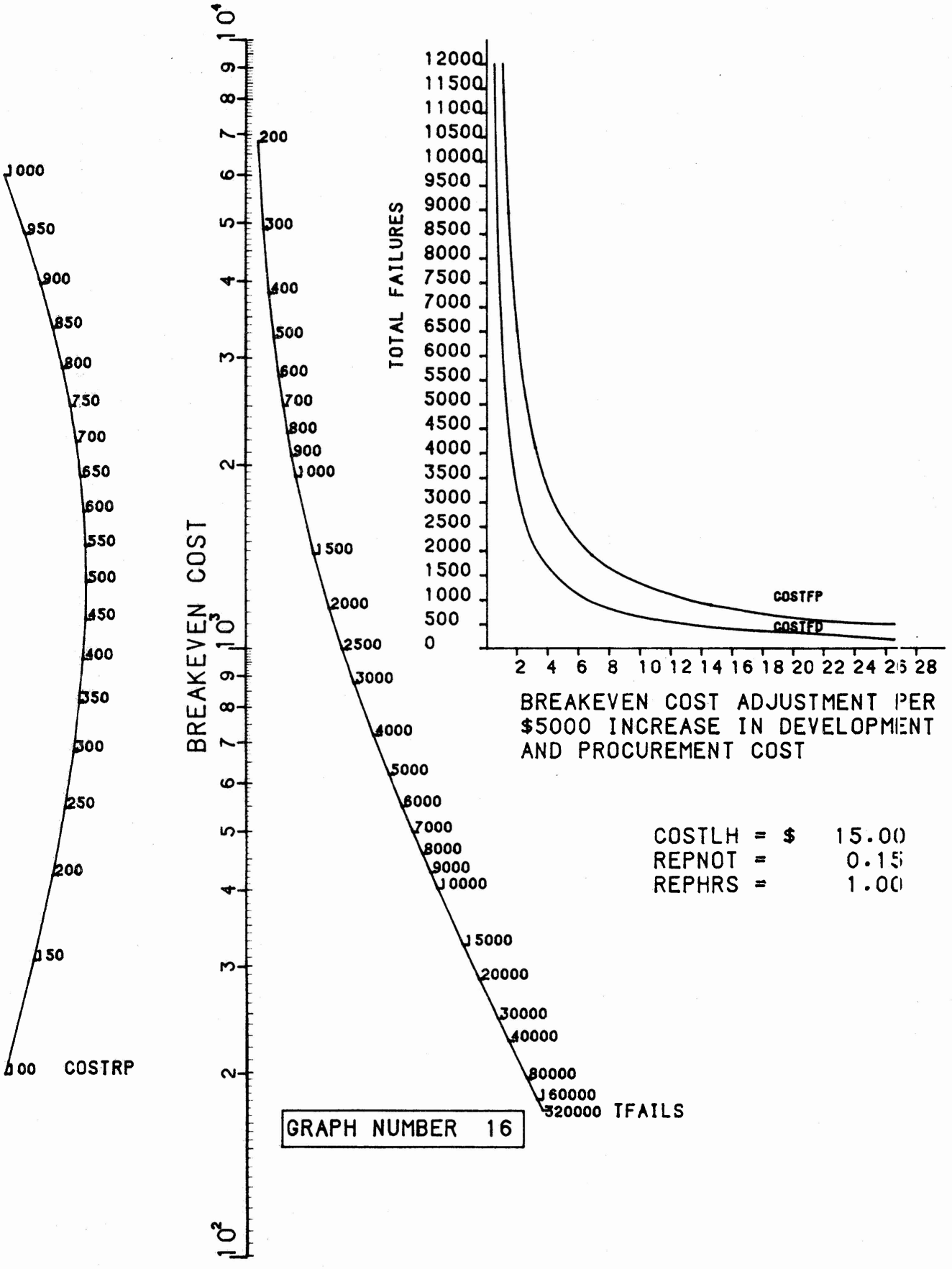
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.15
REPHRS = 0.50
GRAPH NUMBER 14


BREAKEVEN COST
TOTAL FAILURES
COSTFP
COSTFD
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.15
REPHRS = 0.75
COSTRP
TFAILS
GRAPH NUMBER 15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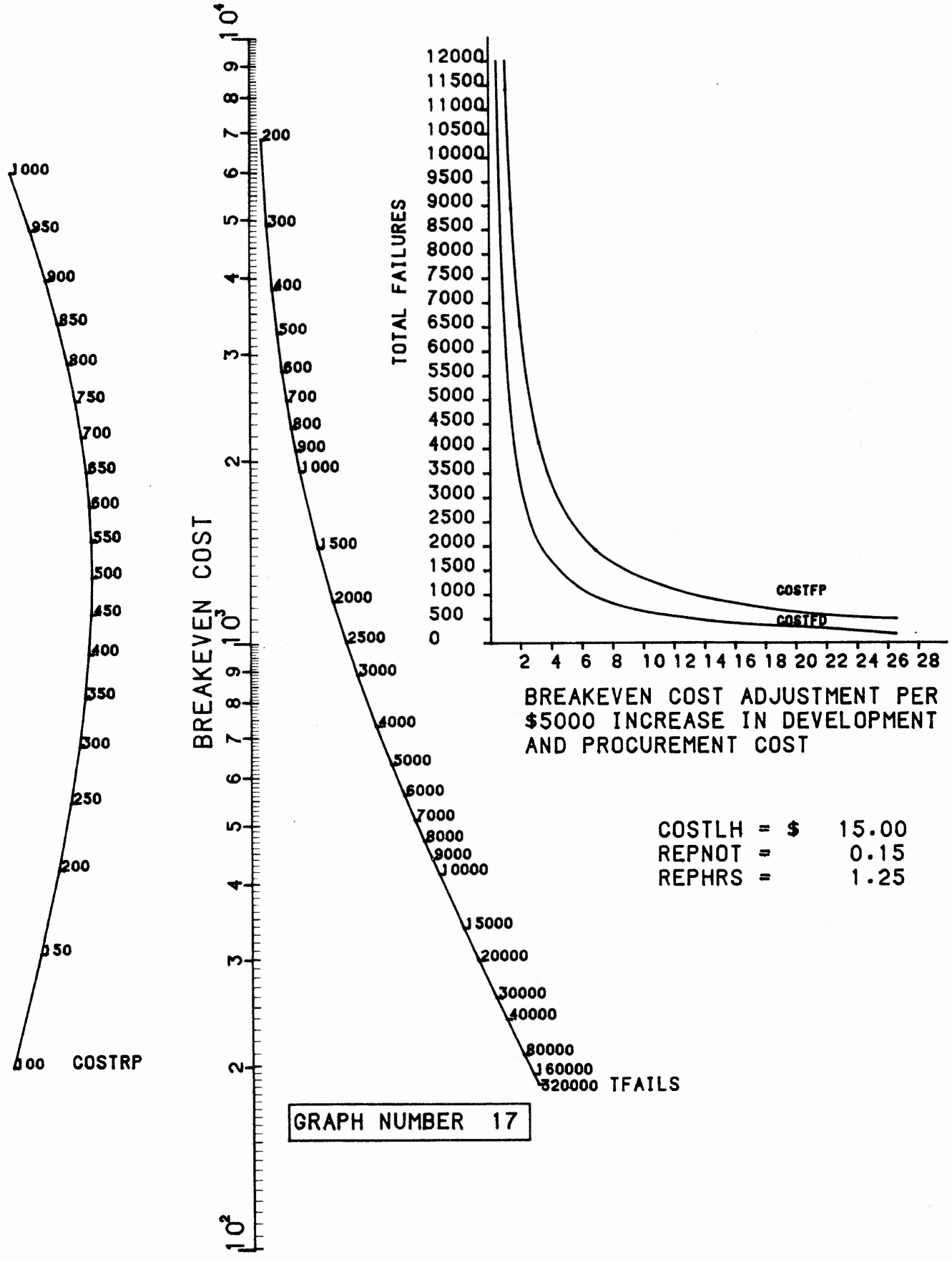
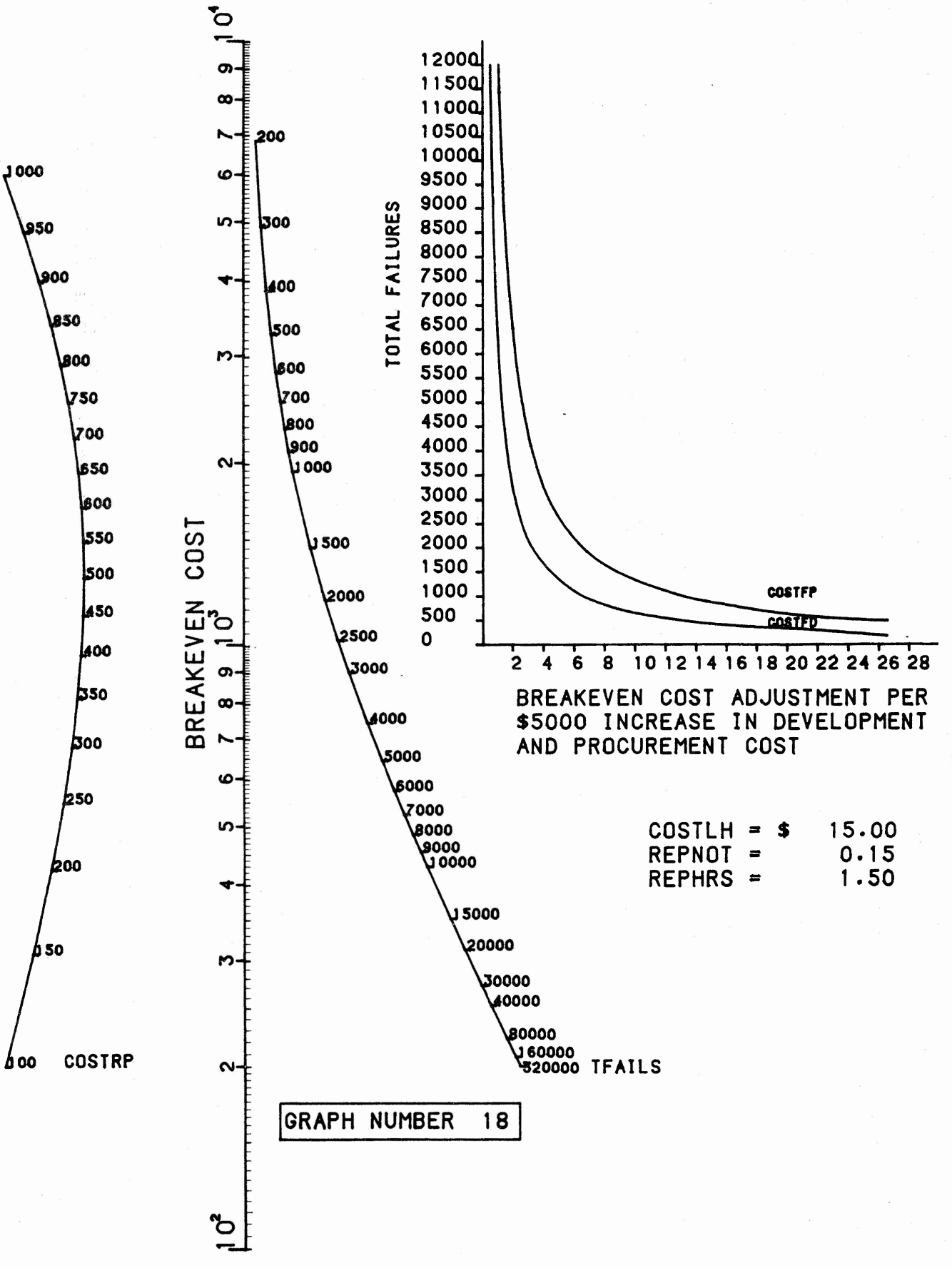
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.15
REPHRS = 1.00
GRAPH NUMBER 16


BREAKEVEN COST
TOTAL FAILURES
COSTFP
COSTFD
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.15
REPHRS = 1.25
COSTRP
TFAILS
GRAPH NUMBER 17


BREAKEVEN COST
TOTAL FAILURES
COSTRP
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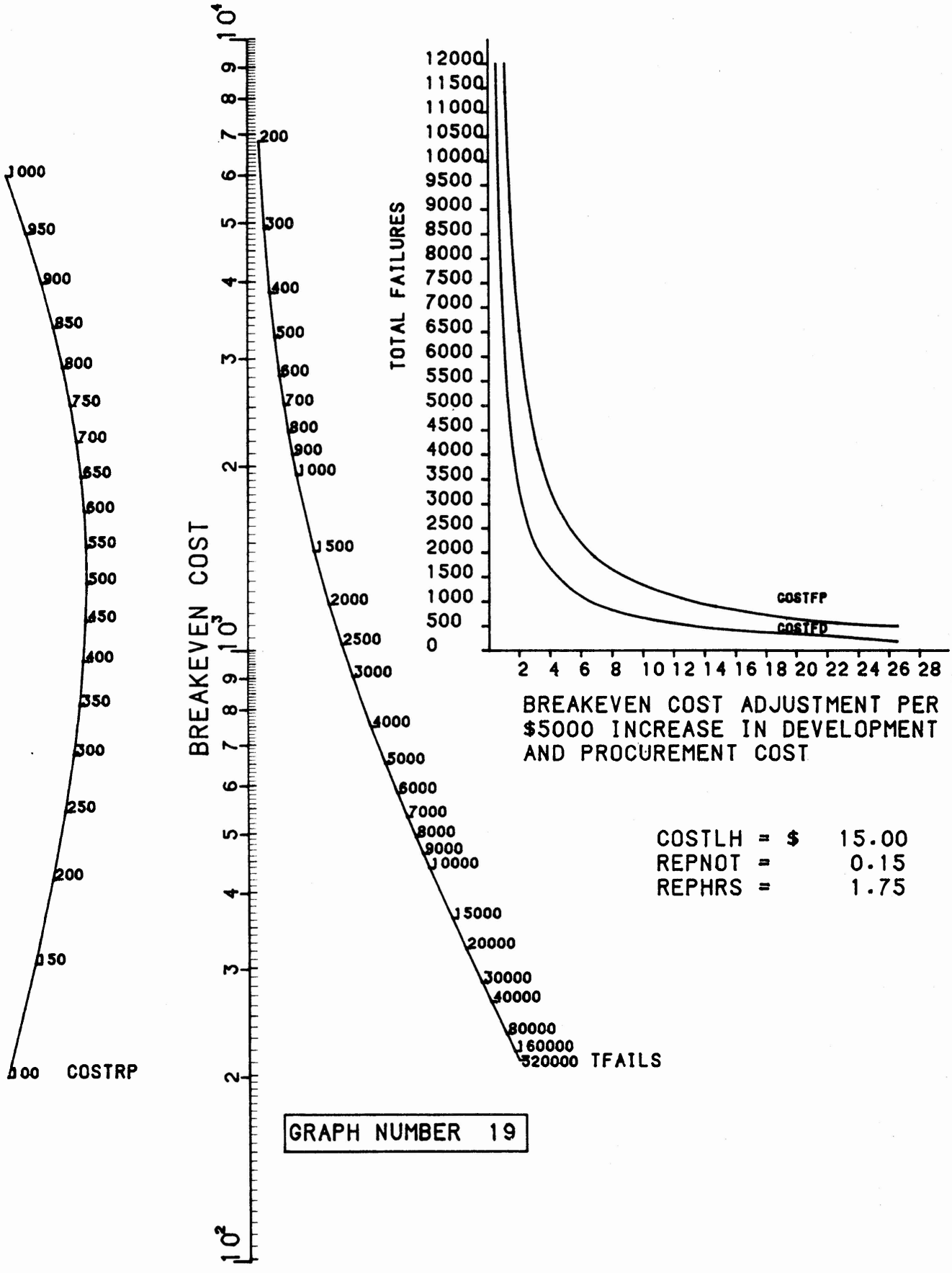
COSTFP
COSTFD
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.15
REPHRS = 1.50
GRAPH NUMBER 18


BREAKEVEN COST
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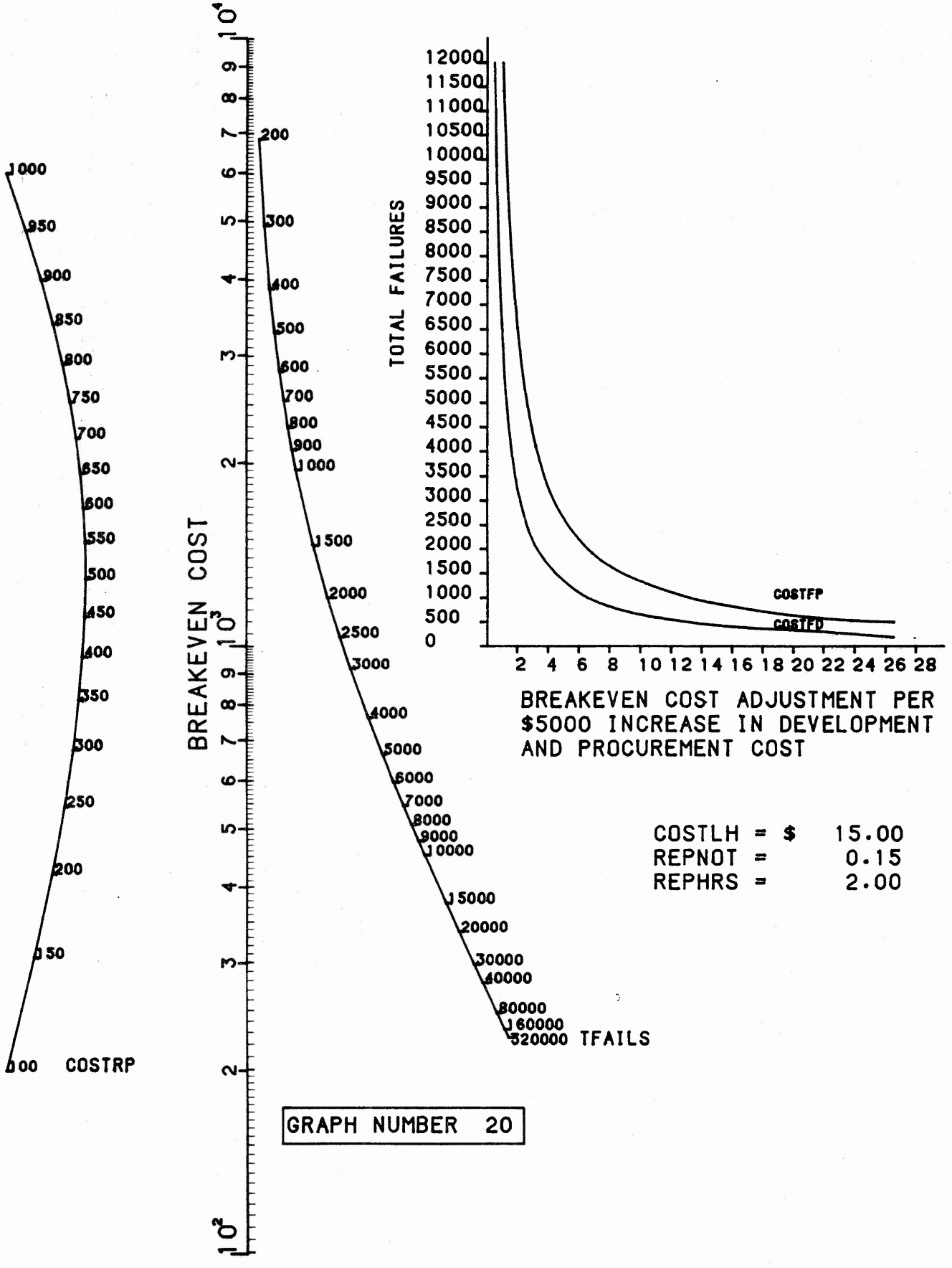
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.15
REPHRS = 1.75
GRAPH NUMBER 19


BREAKEVEN COST
TOTAL FAILURES
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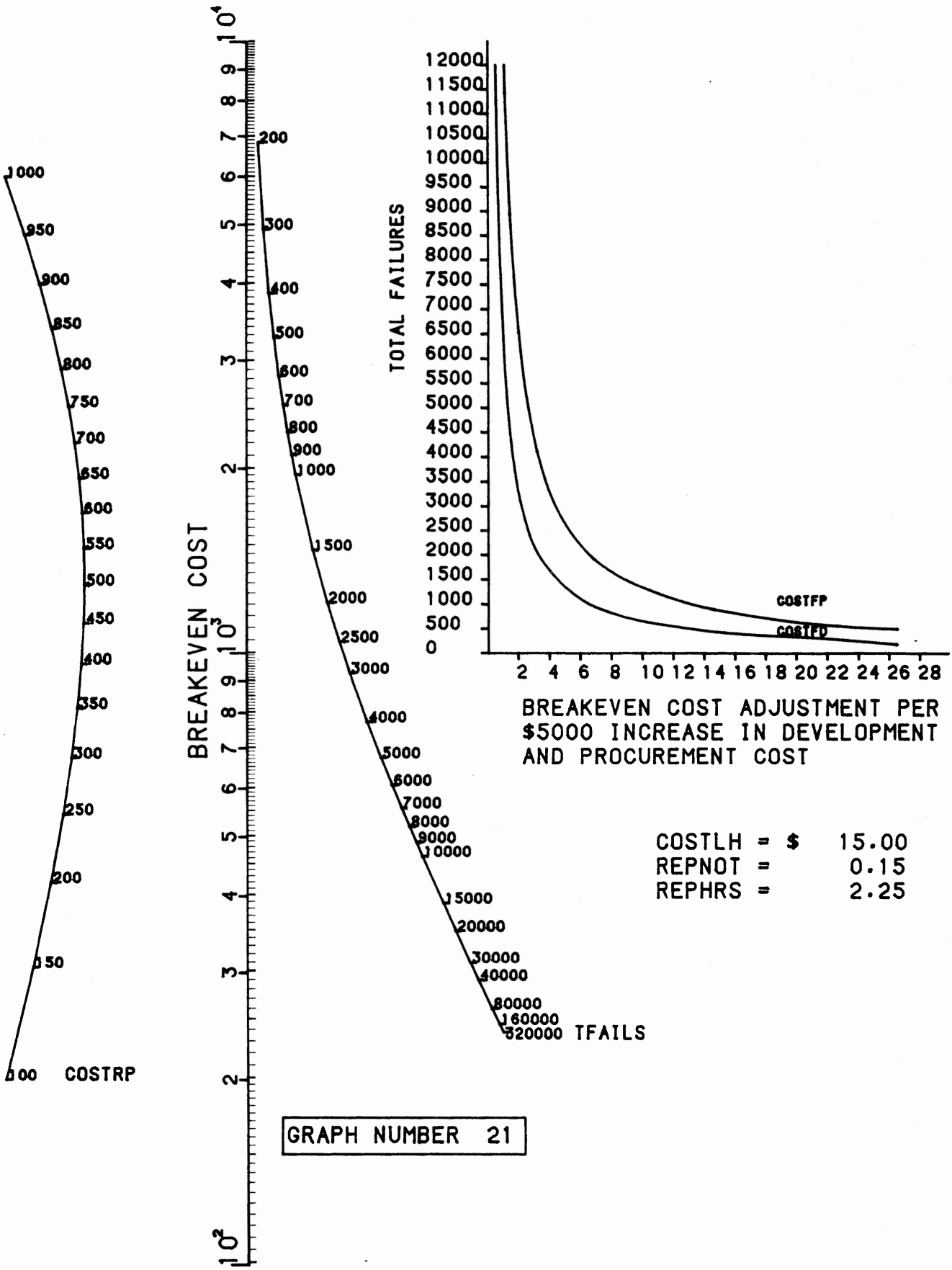
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.15
REPHRS = 2.00
GRAPH NUMBER 20


BREAKEVEN COST
TOTAL FAILURES
COSTRP
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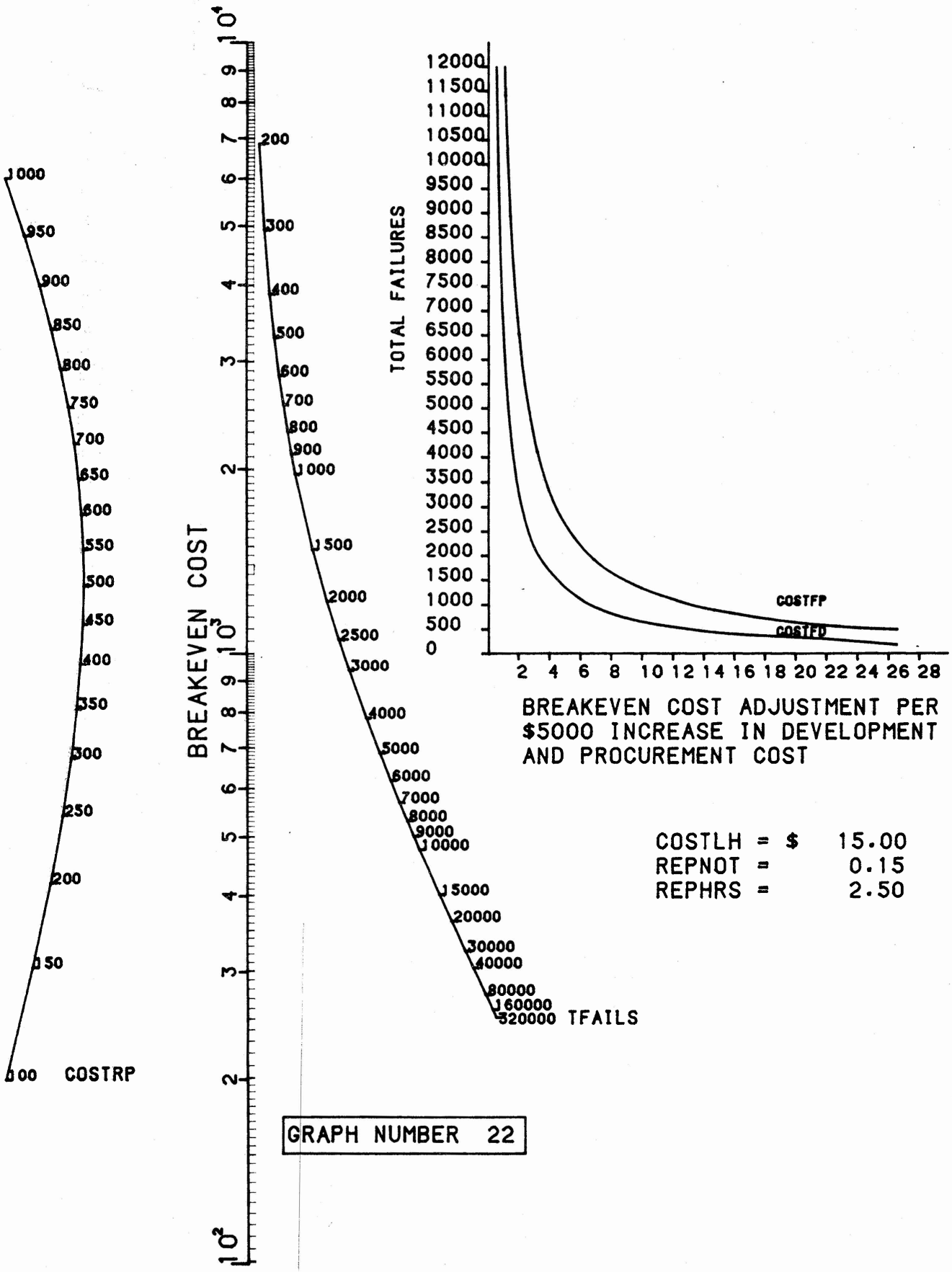
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.15
REPHRS = 2.25
GRAPH NUMBER 21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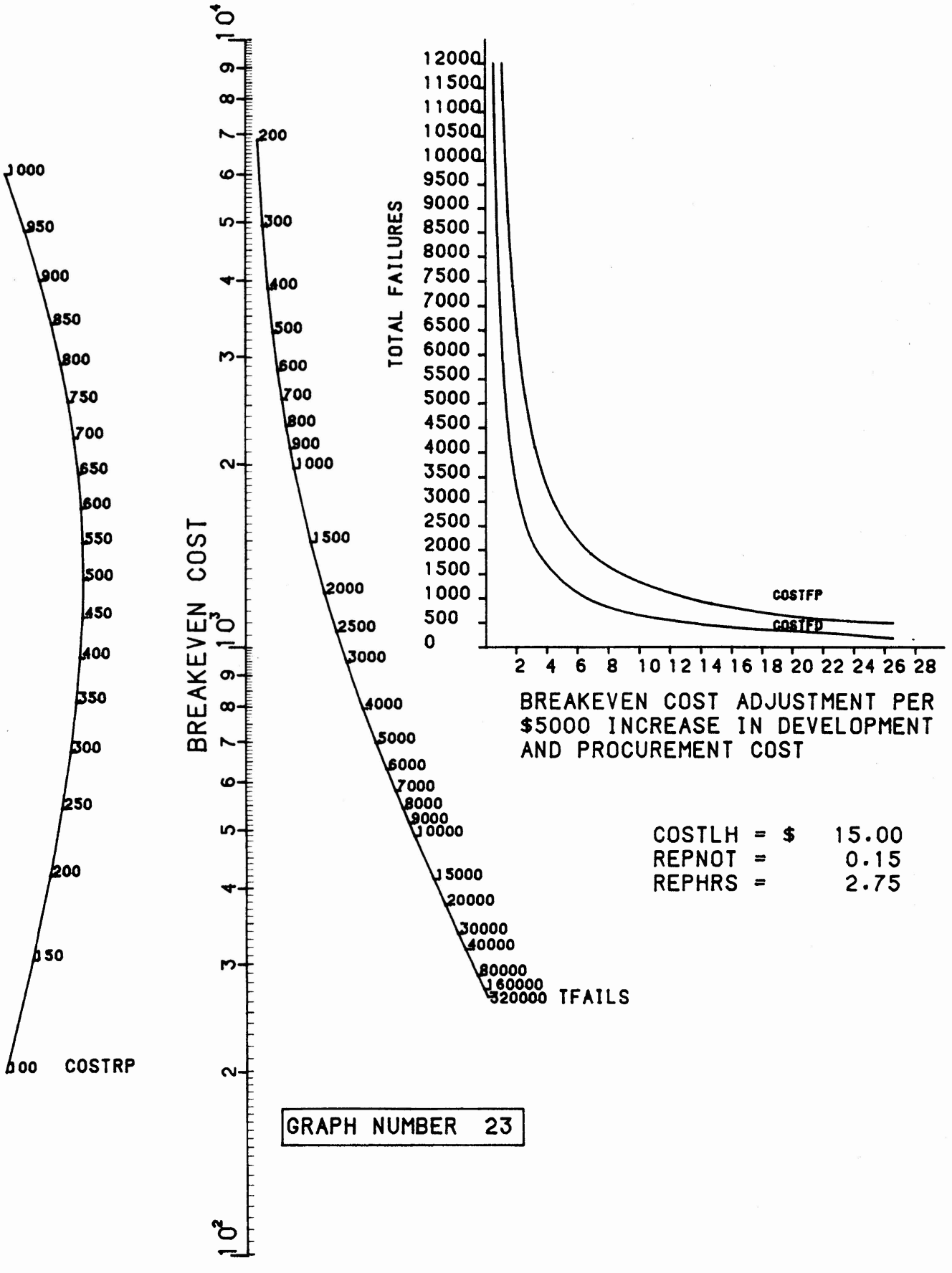
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.15
REPHRS = 2.50
GRAPH NUMBER 22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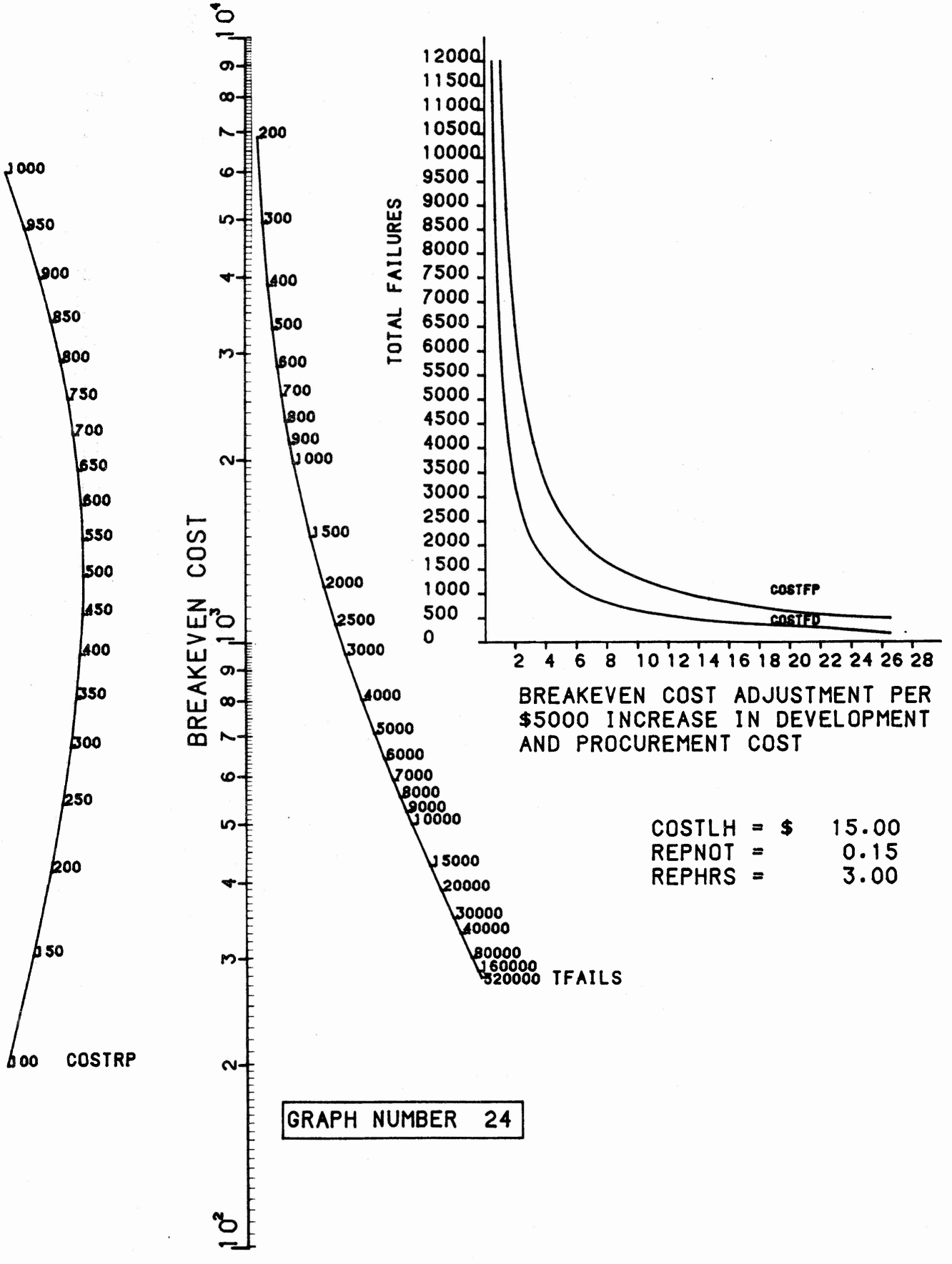
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.15
REPHRS = 2.75
GRAPH NUMBER 23


BREAKEVEN COST
TOTAL FAILURES
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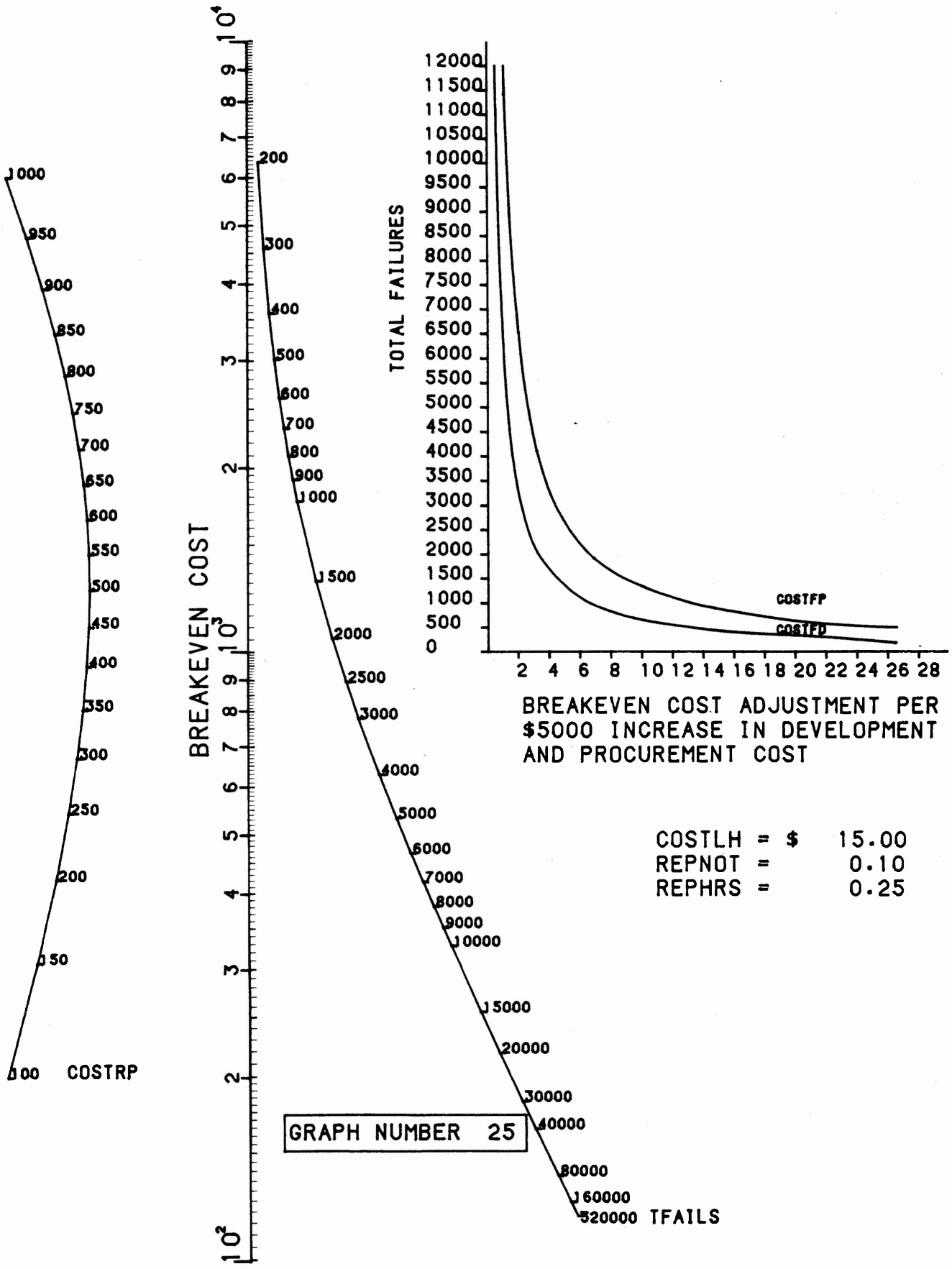
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.15
REPHRS = 3.00
GRAPH NUMBER 24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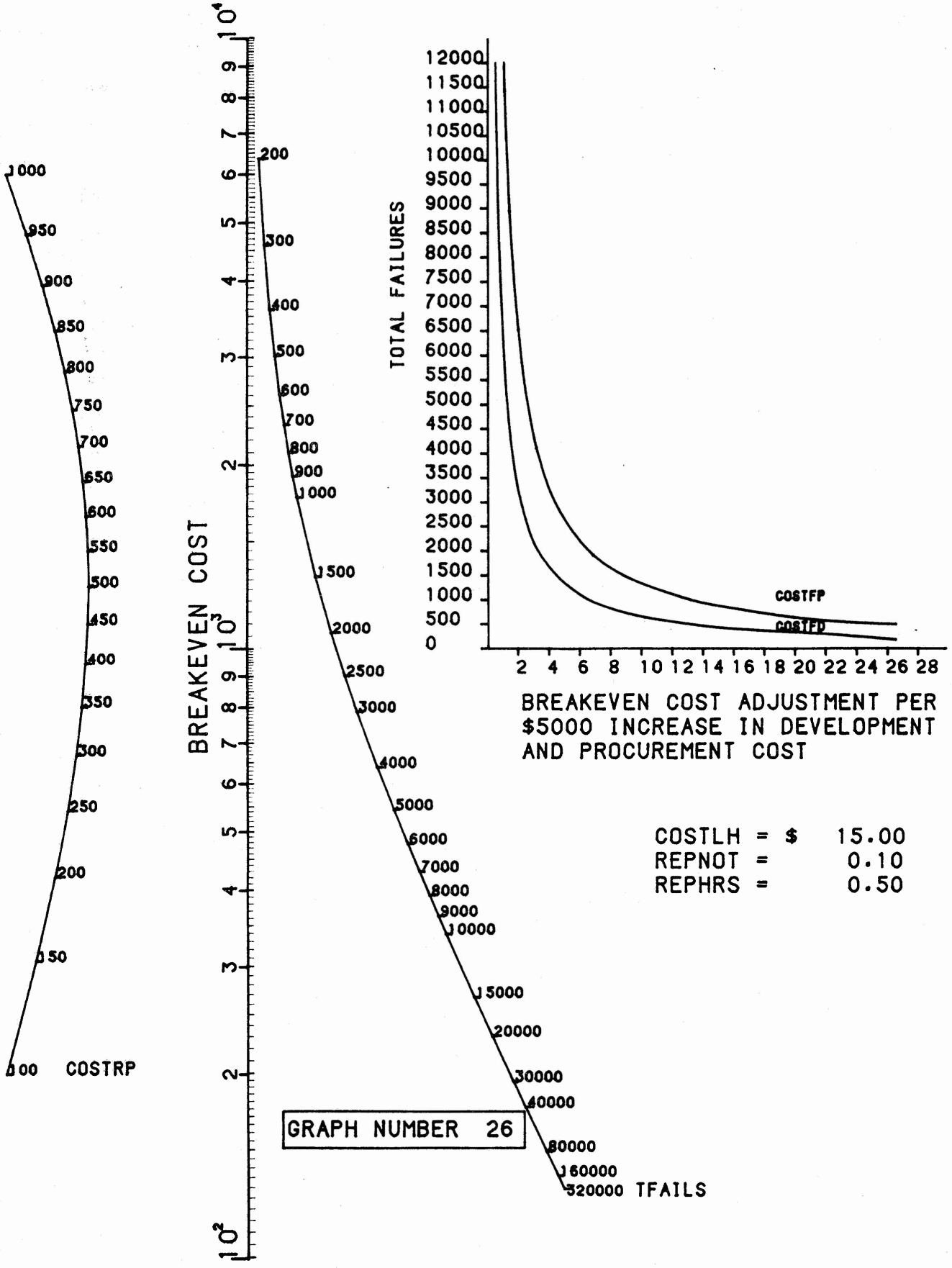
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.10
REPHRS = 0.25
GRAPH NUMBER 25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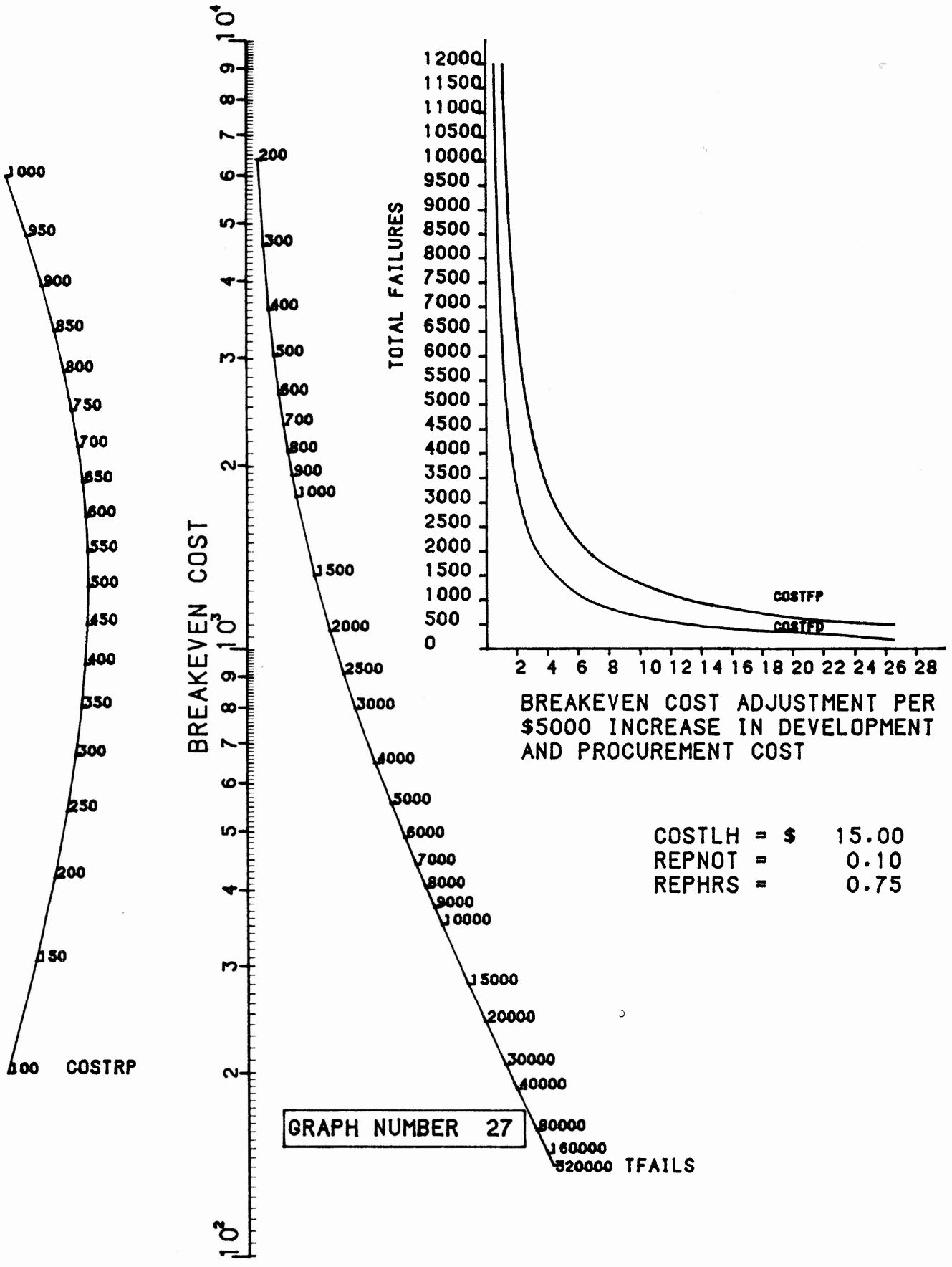
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.10
REPHRS = 0.50
GRAPH NUMBER 26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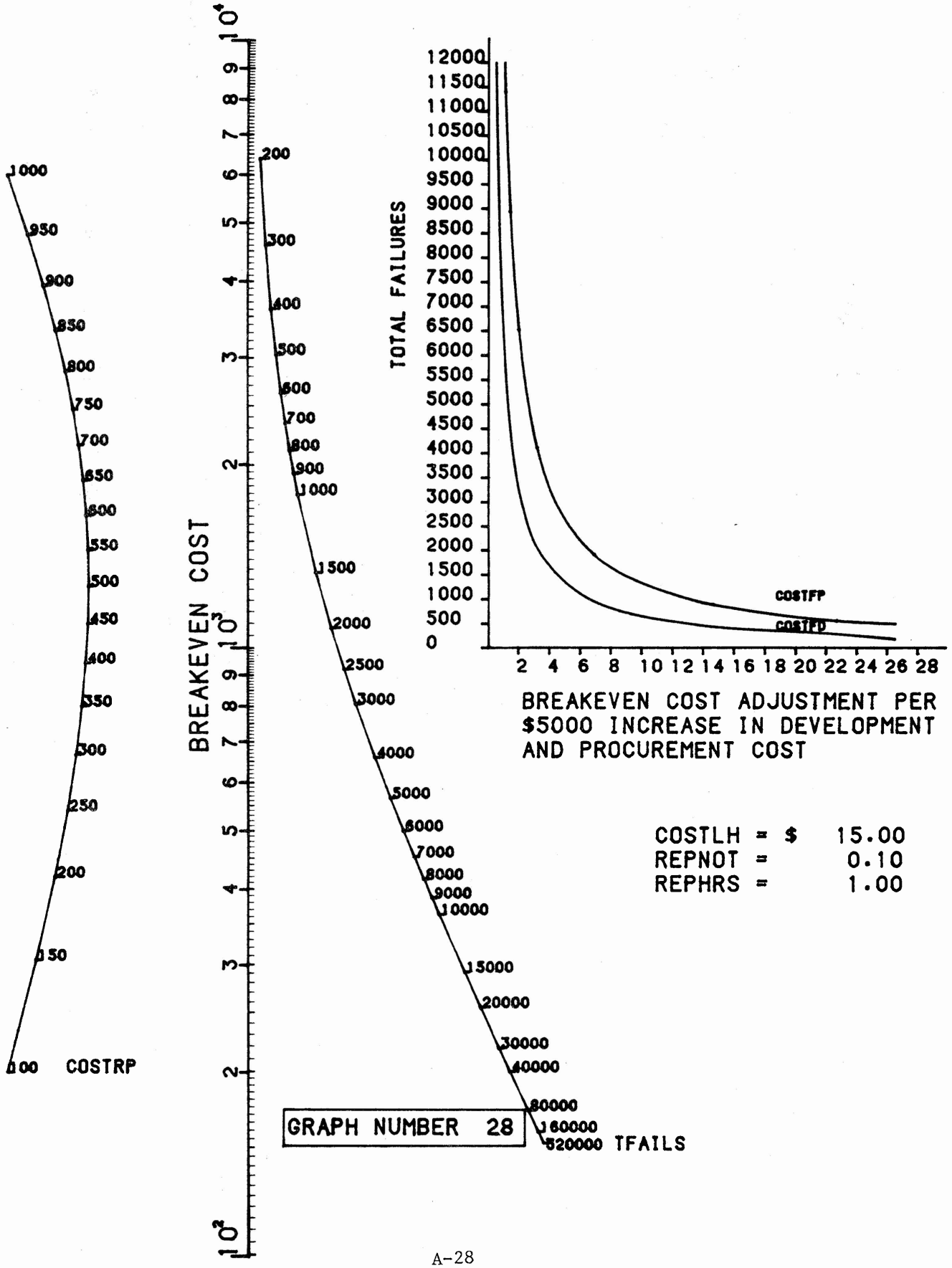
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.10
REPHRS = 0.75
GRAPH NUMBER 27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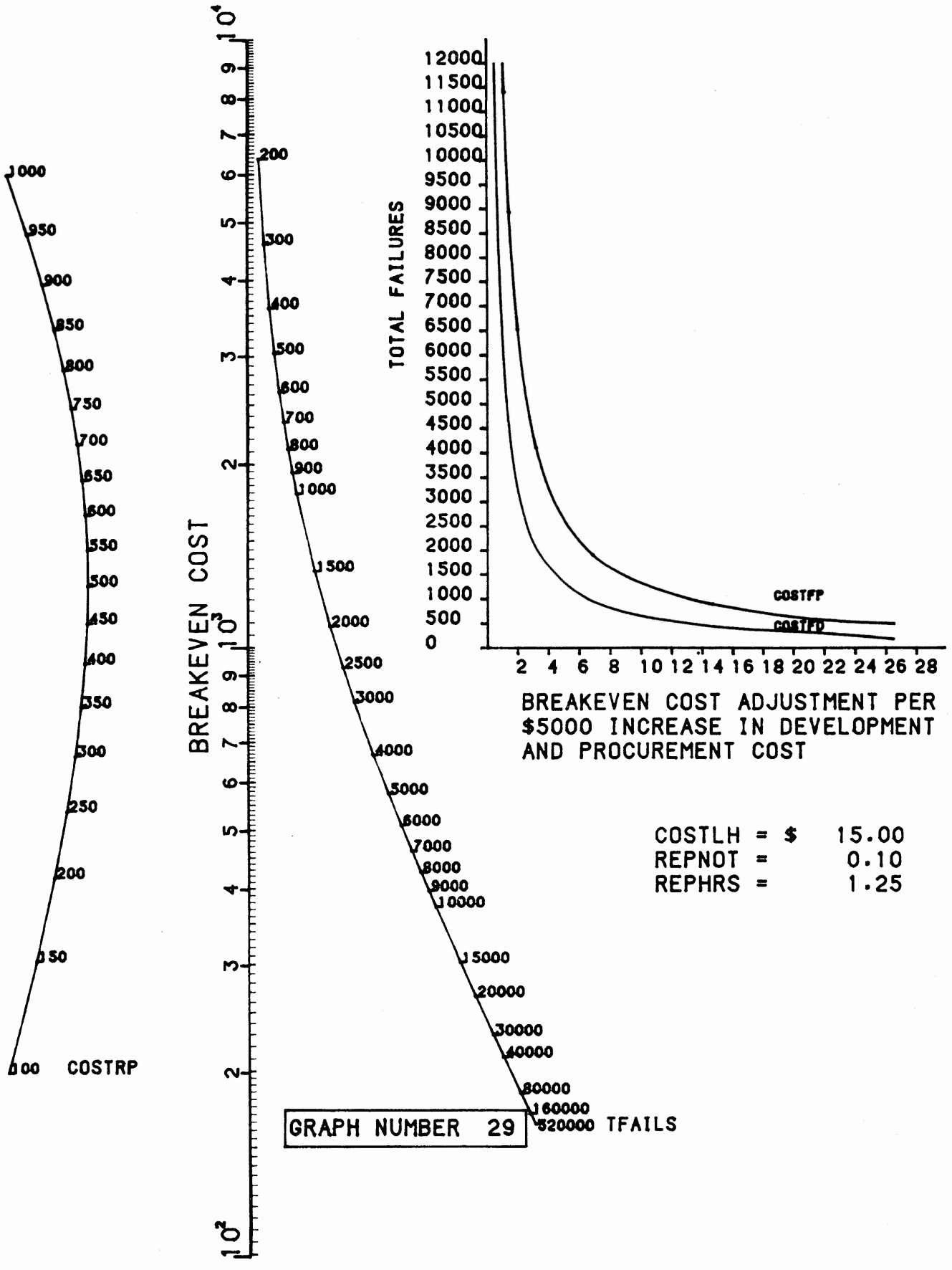
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.10
REPHRS = 1.00
GRAPH NUMBER 28


BREAKEVEN COST
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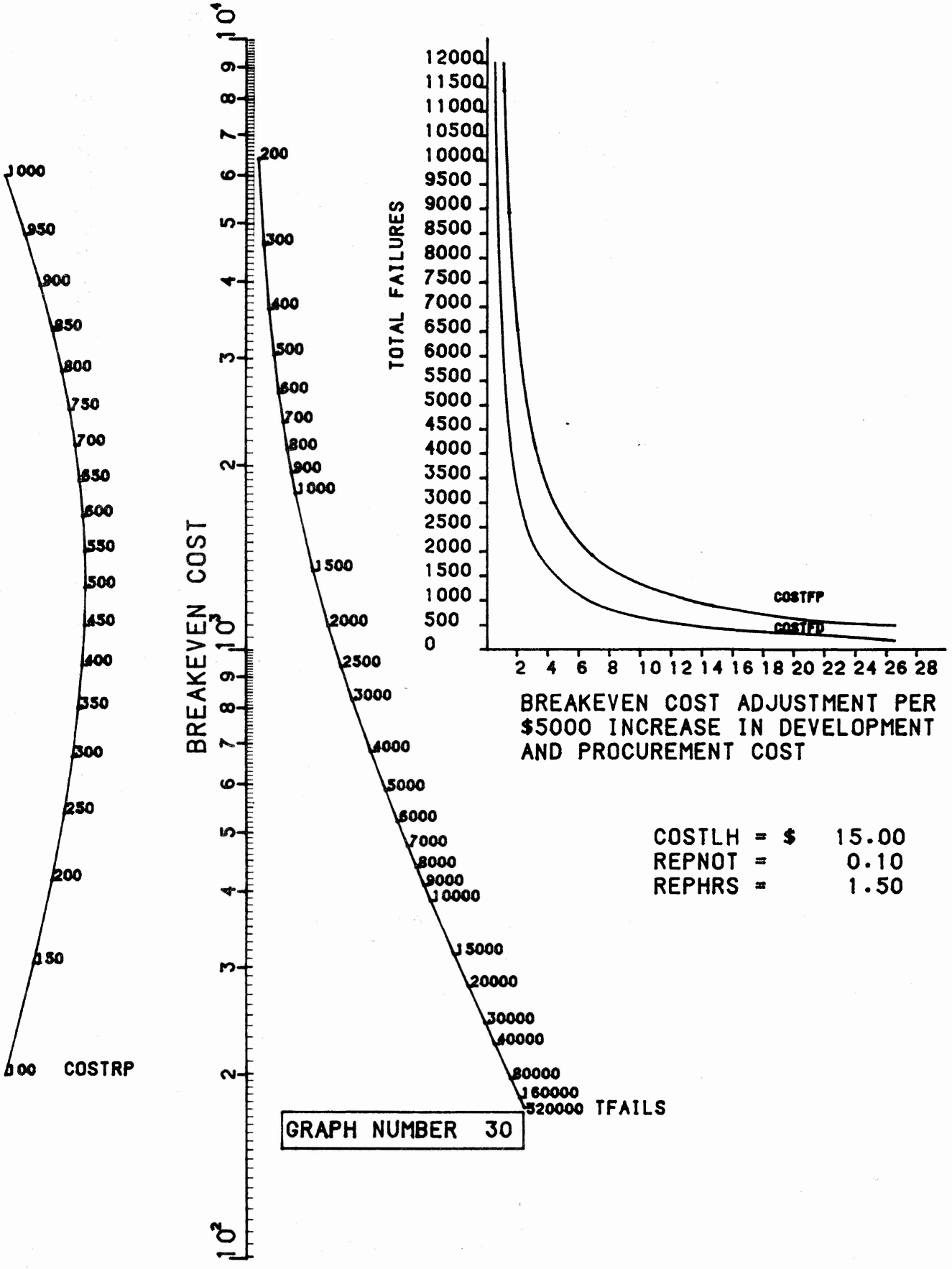
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.10
REPHRS = 1.25
GRAPH NUMBER 29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5000
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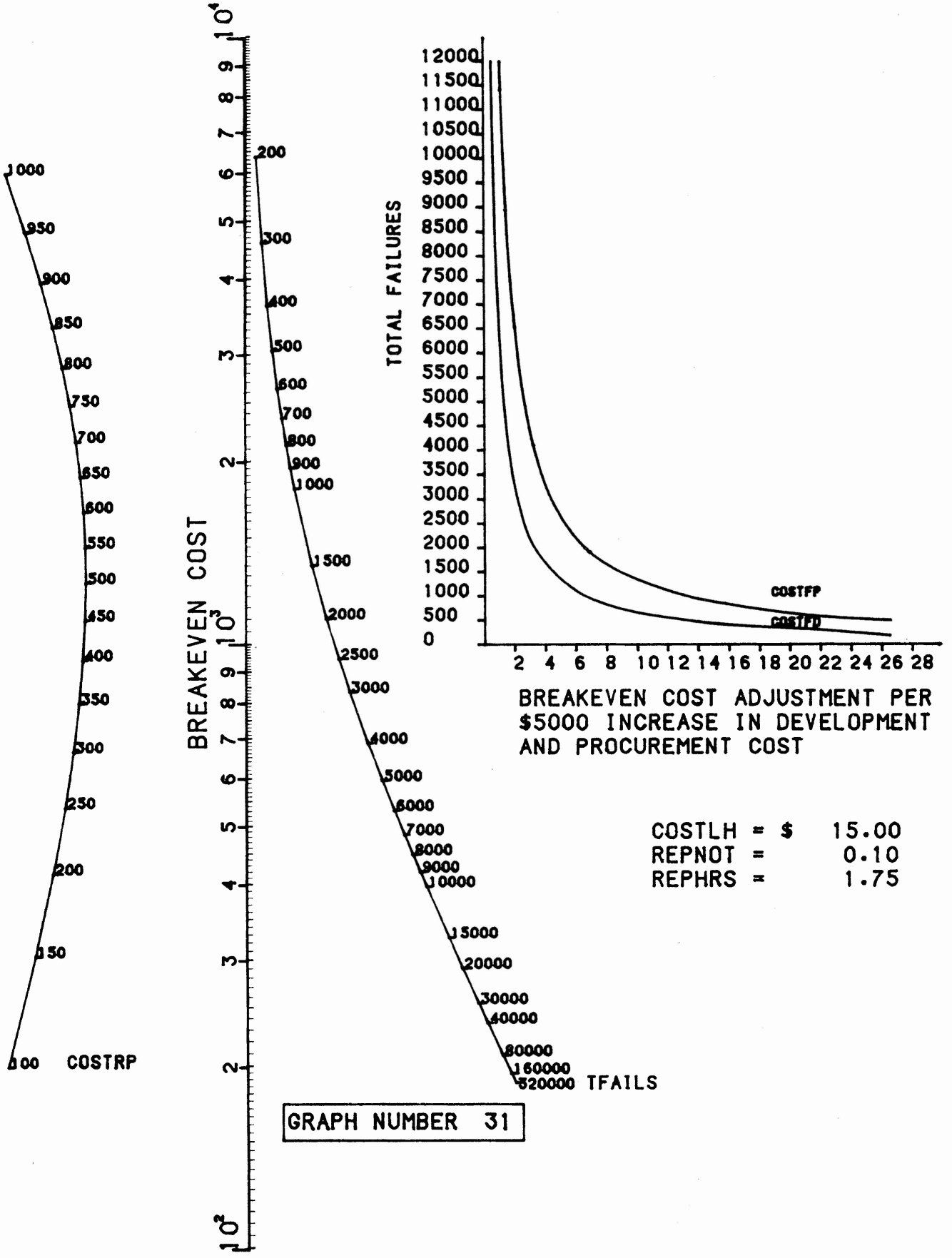
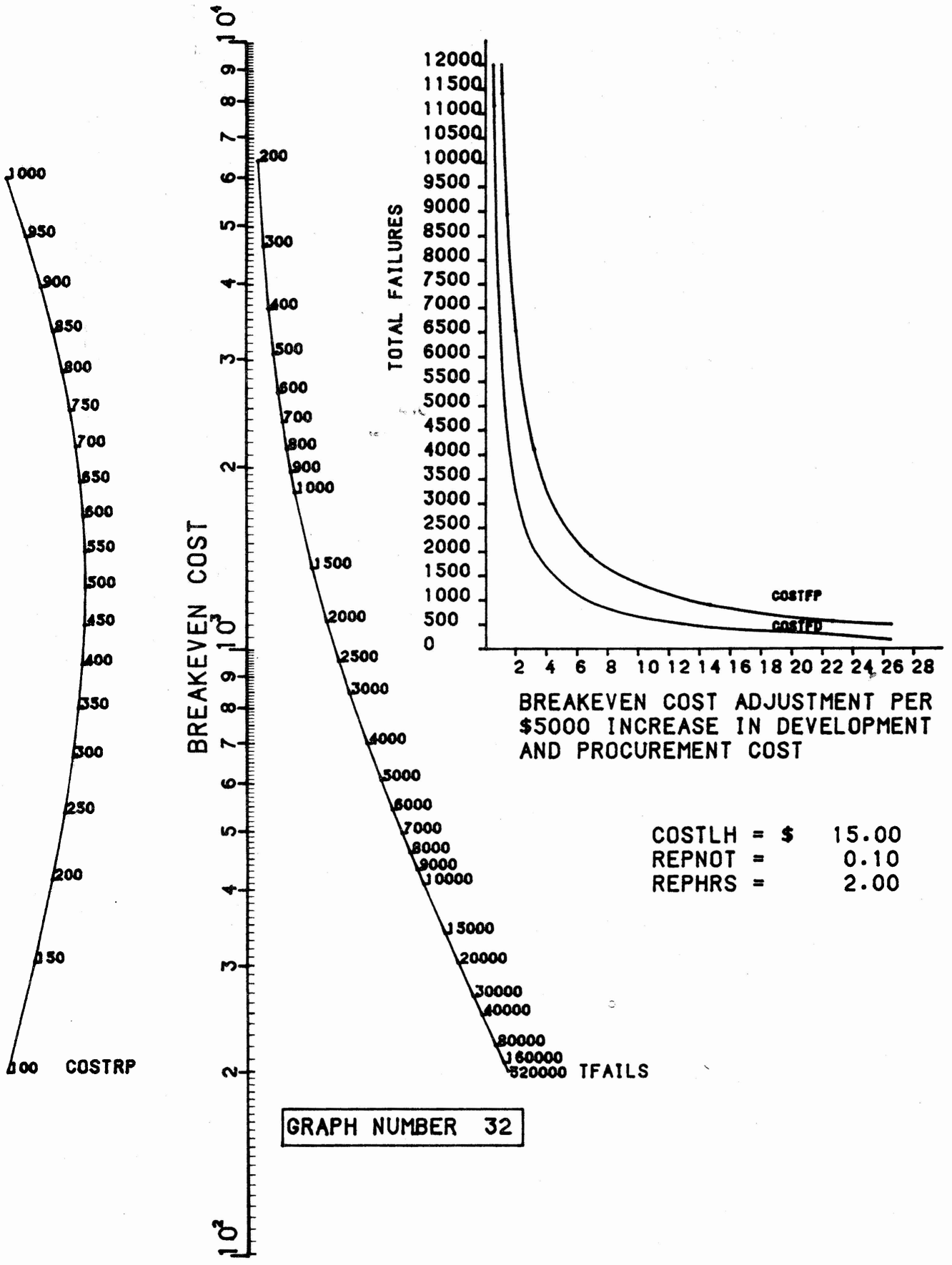
3500
3000
2500
2000
1500
1000
500
0
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.10
REPHRS = 1.50
GRAPH NUMBER 30


BREAKEVEN COST
TOTAL FAILURES
COSTRP
TFAILS
COSTFP
COSTFD
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.10
REPHRS = 1.75
GRAPH NUMBER 31


1000
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200
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COSTRP
BREAKEVEN COST
10^4
9
8
7
6
5
4
3
2
10^3
9
8
7
6
5
4
3
2
10^2
200
300
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500
600
700
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TFAILS
TOTAL FAILURES
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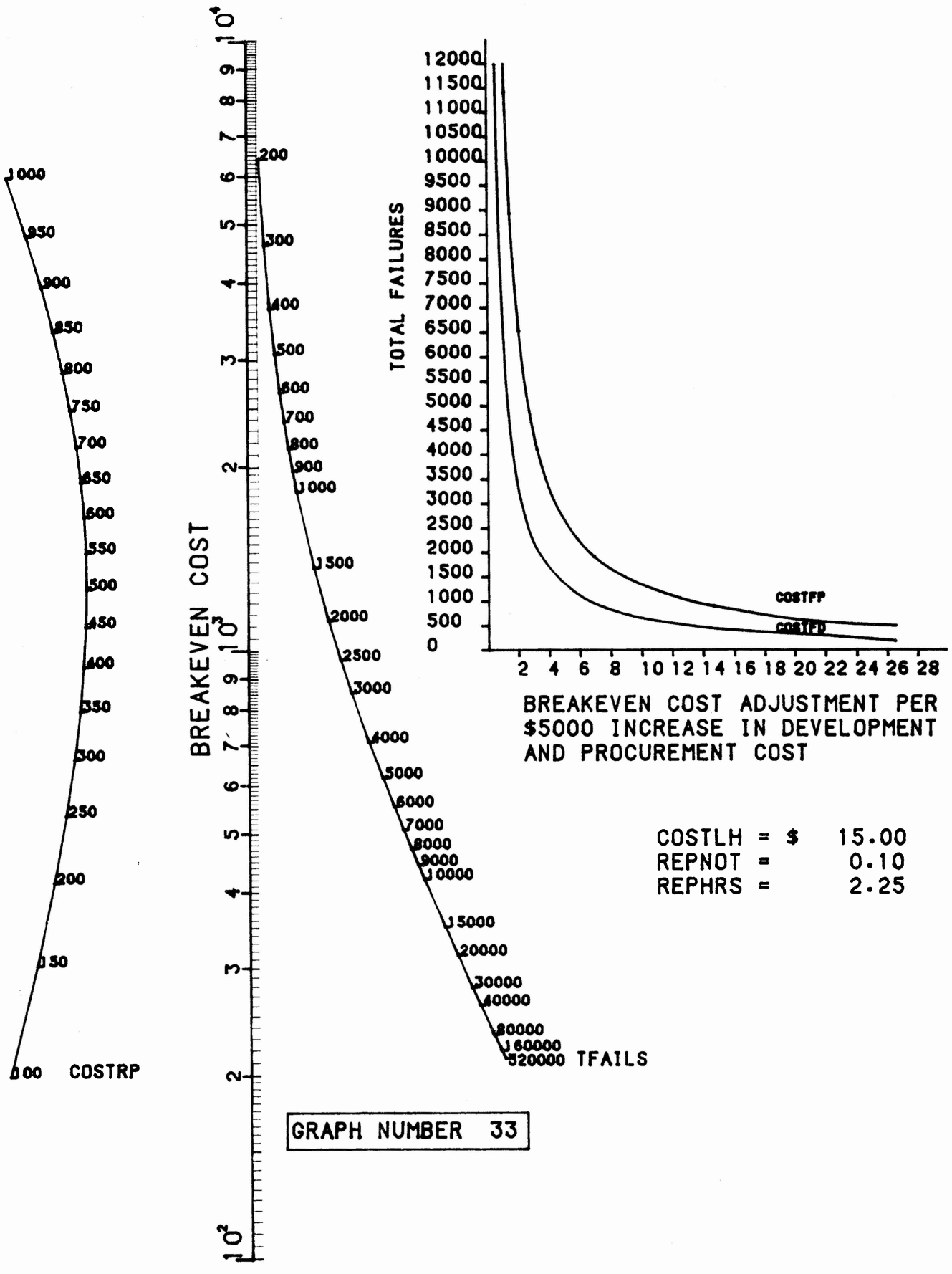
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.10
REPHRS = 2.00
GRAPH NUMBER 32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COSTRP
BREAKEVEN COST
10^4
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10^3
9
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3
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10^2
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TFAILS
TOTAL FAILURES
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1500
1000
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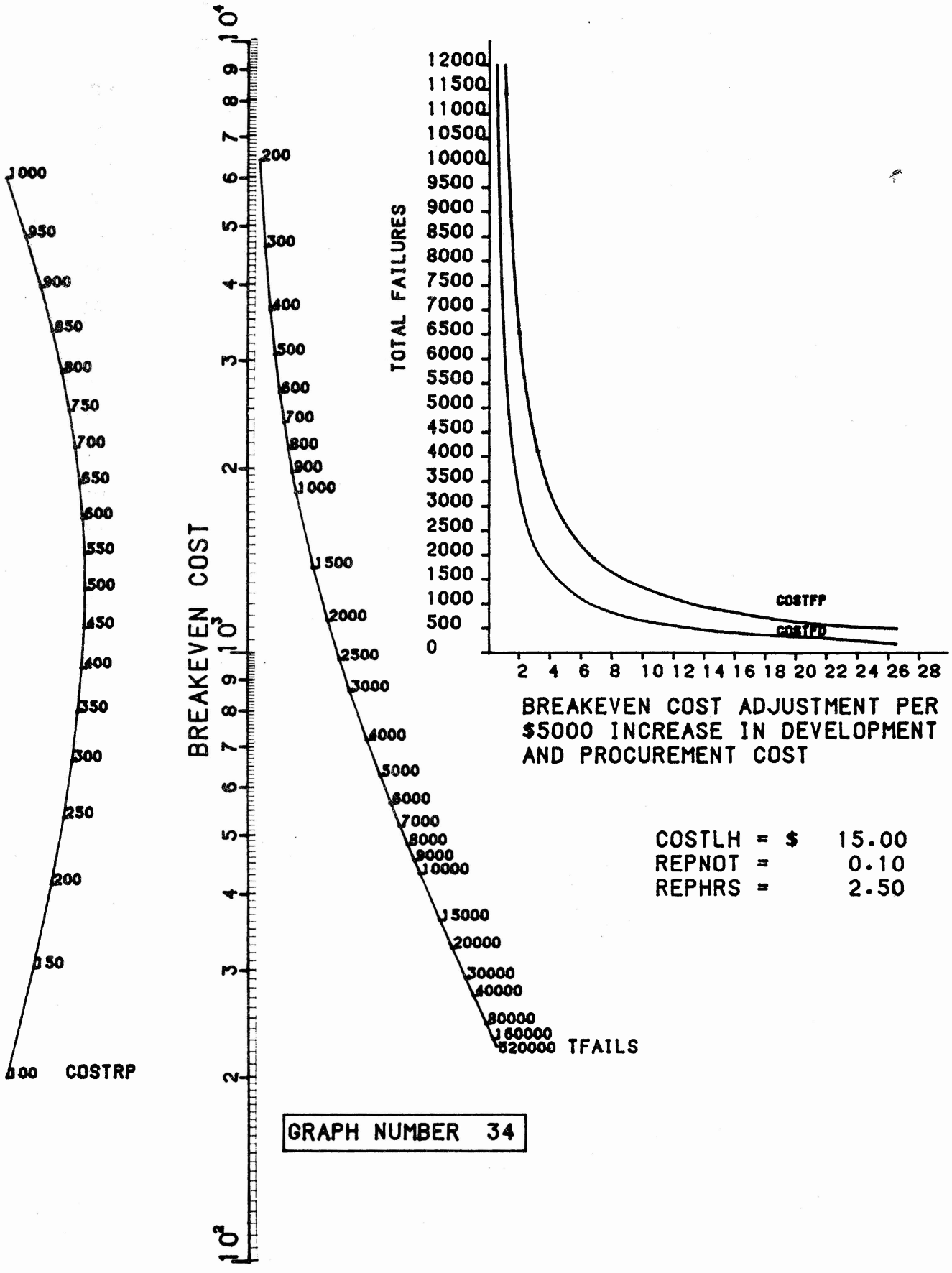
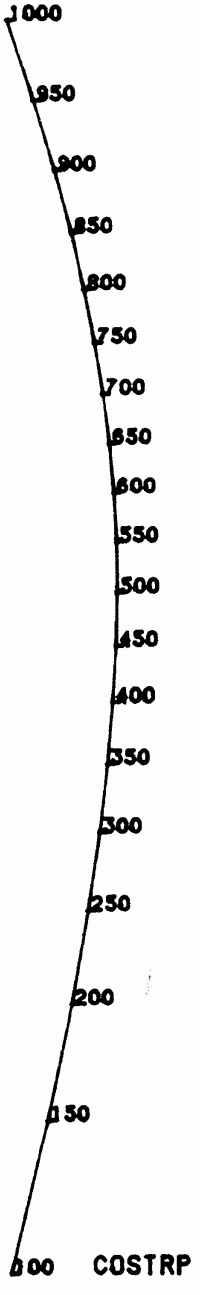
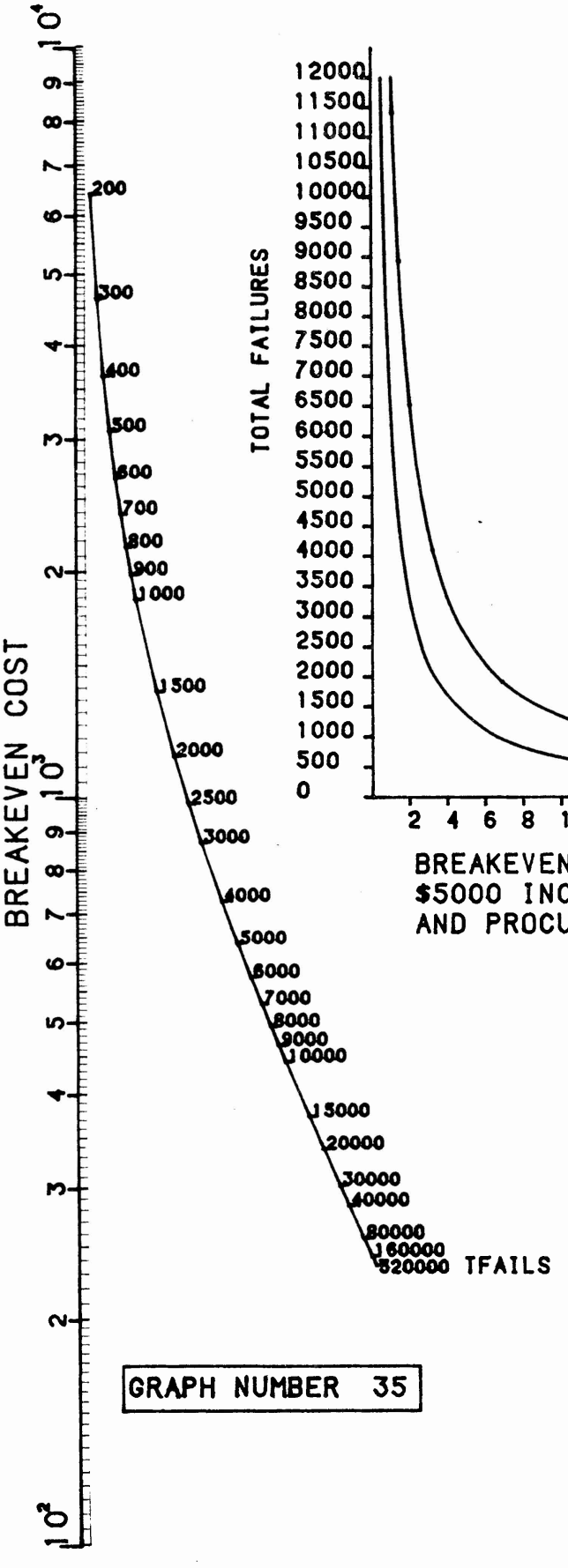
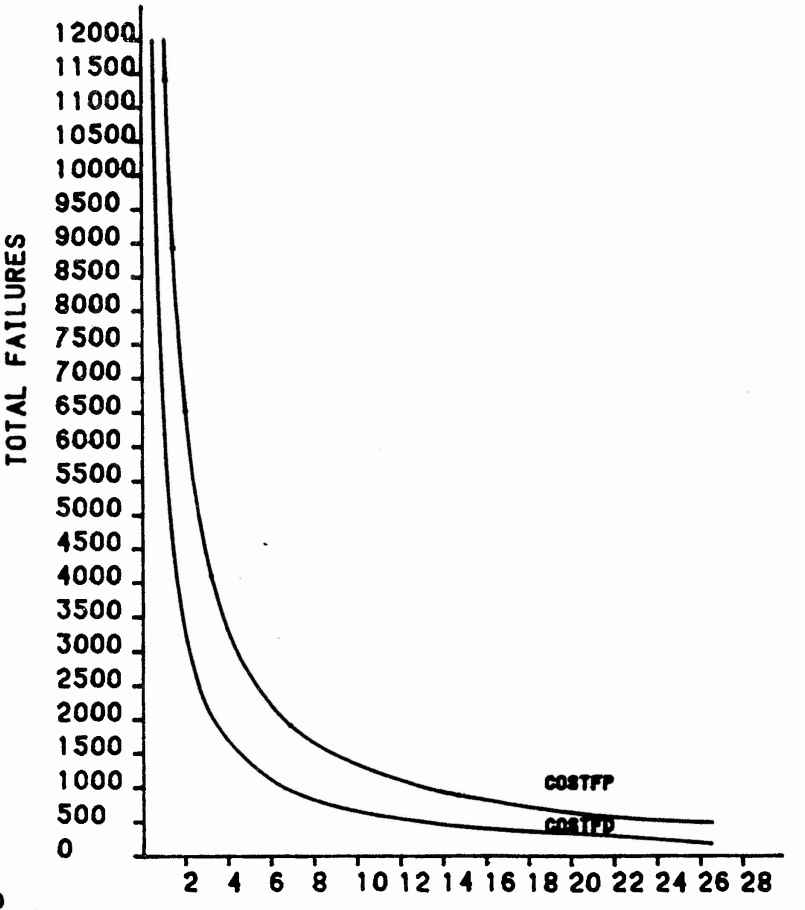
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.10
REPHRS = 2.25
GRAPH NUMBER 33


BREAKEVEN COST
TOTAL FAILURES
COSTRP
TFAILS
COSTFP
COSTFD
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.10
REPHRS = 2.50
GRAPH NUMBER 34

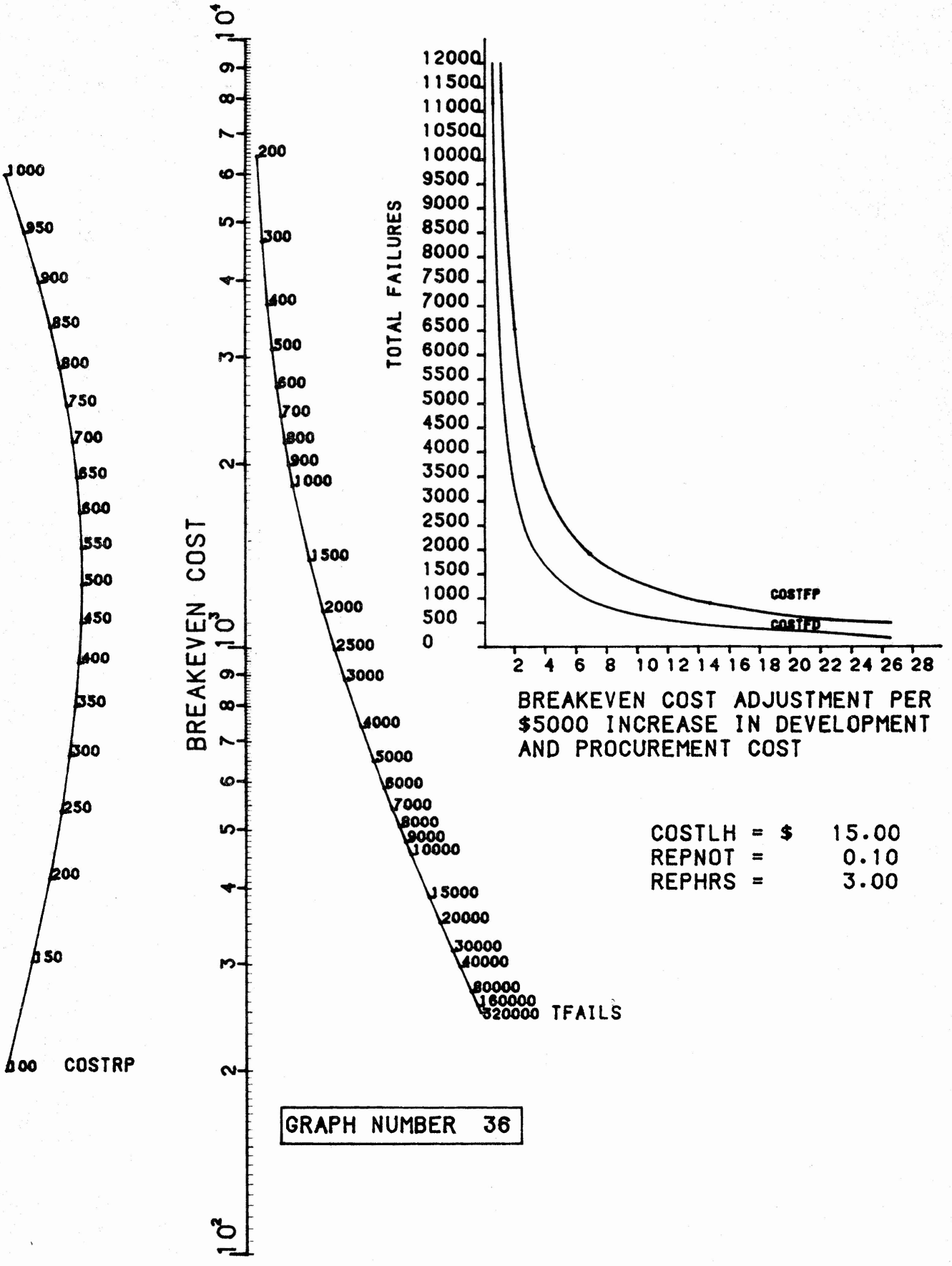






COSTLH = $ 15.00
REPNOT = 0.10
REPHRS = 2.75

GRAPH NUMBER 35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COSTRP
BREAKEVEN COST
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TFAILS
TOTAL FAILURES
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11000
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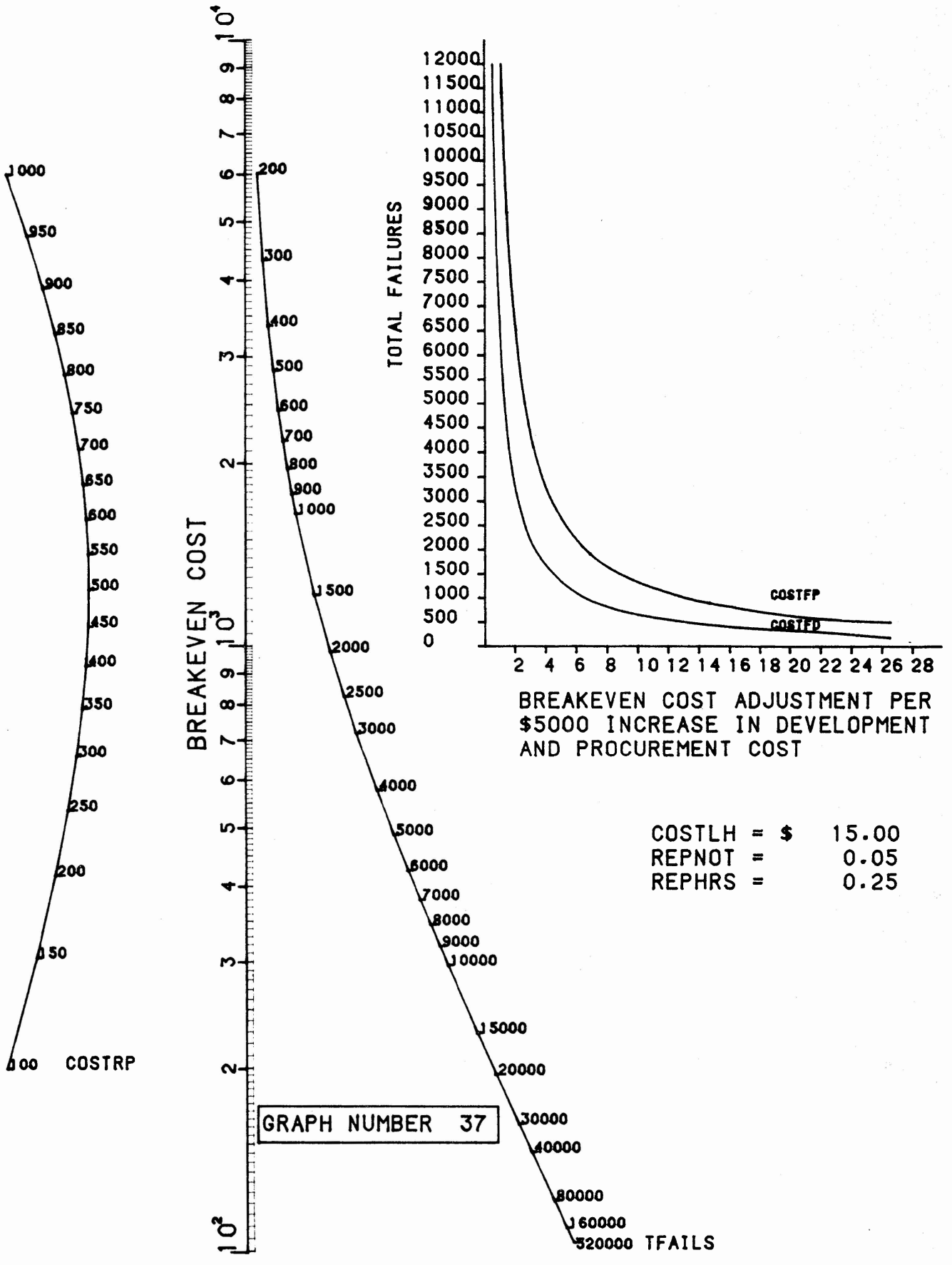
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.10
REPHRS = 3.00
GRAPH NUMBER 36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COSTRP
BREAKEVEN COST
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TFAILS
TOTAL FAILURES
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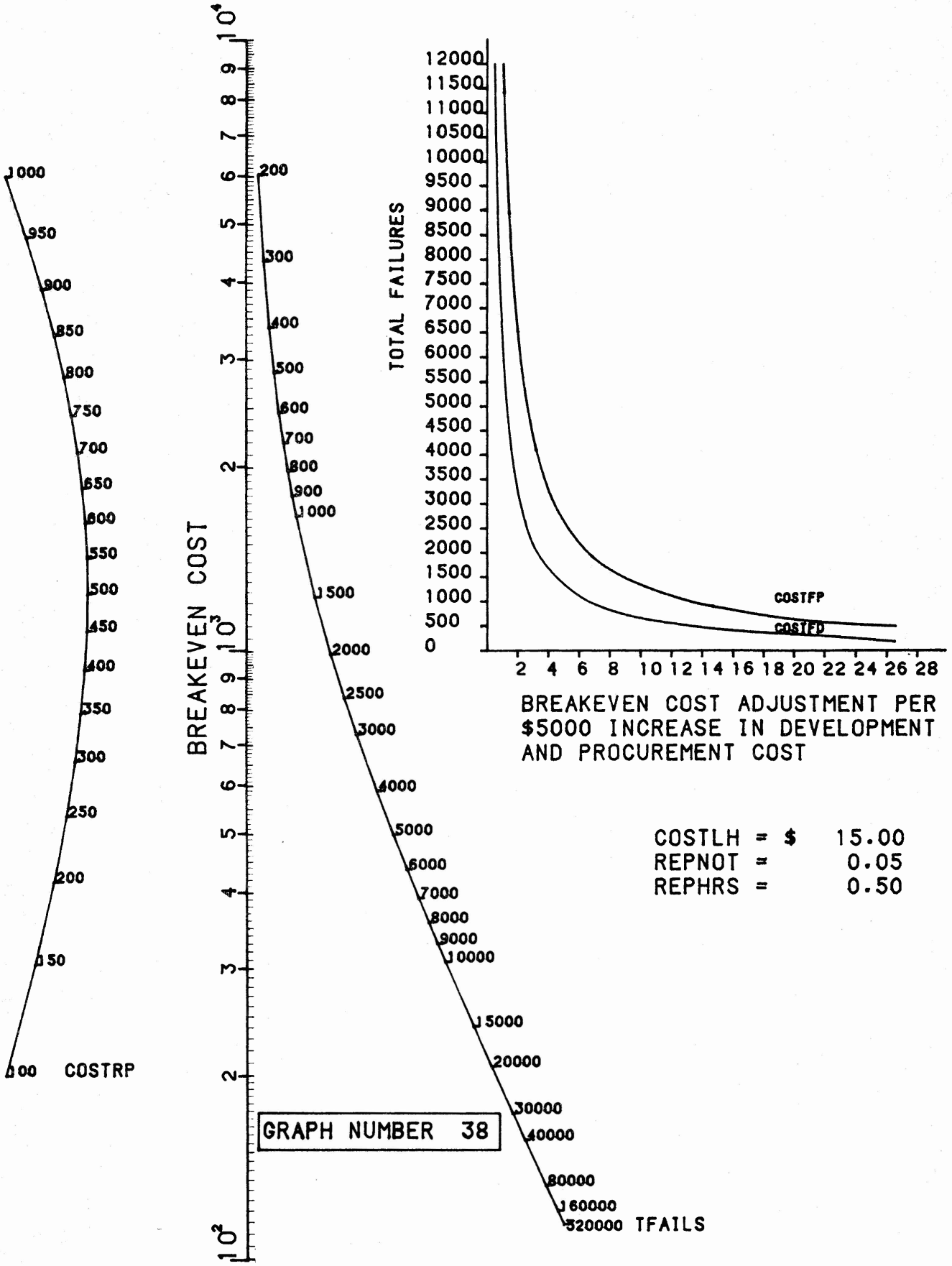
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.05
REPHRS = 0.25
GRAPH NUMBER 37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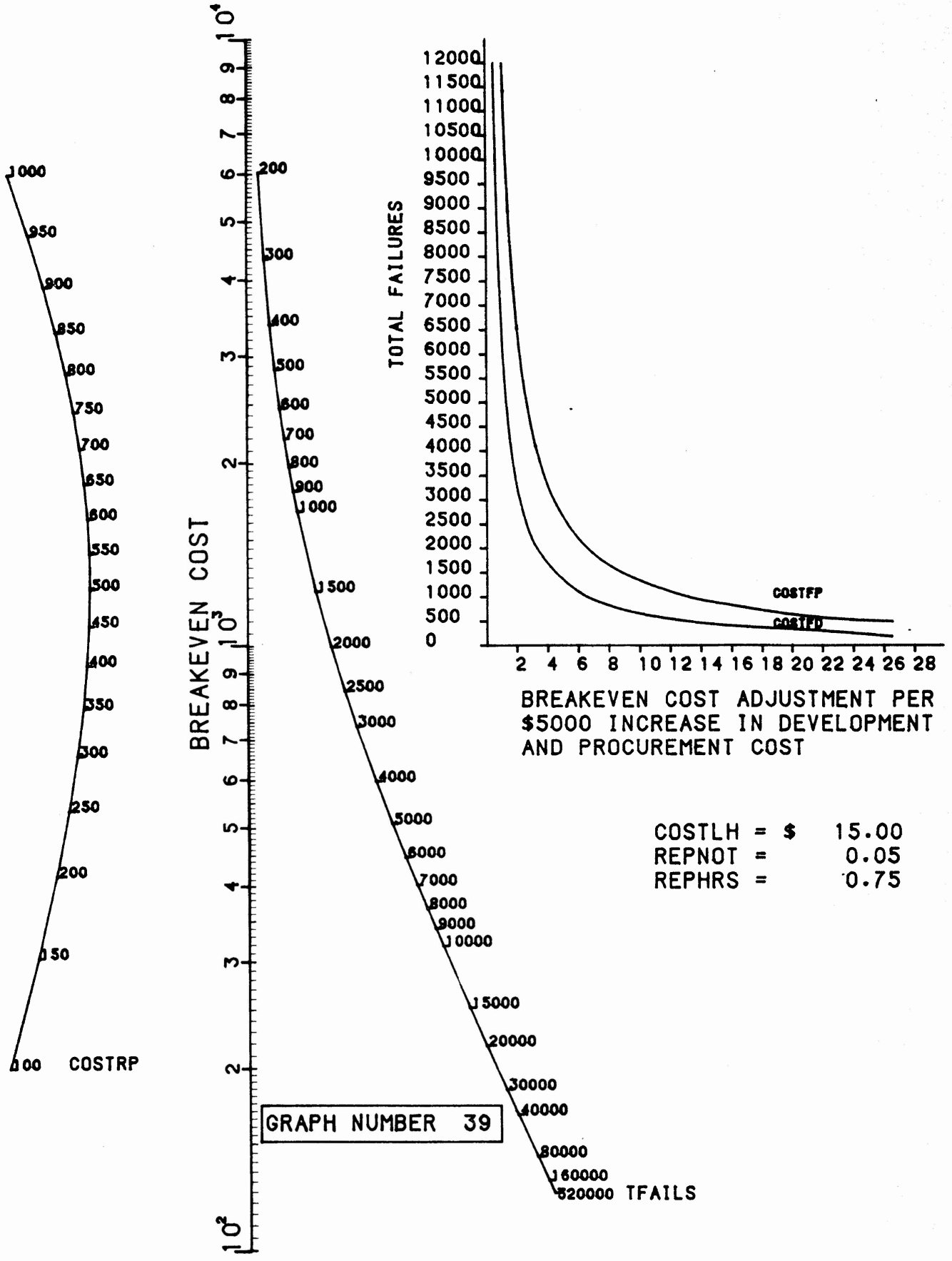
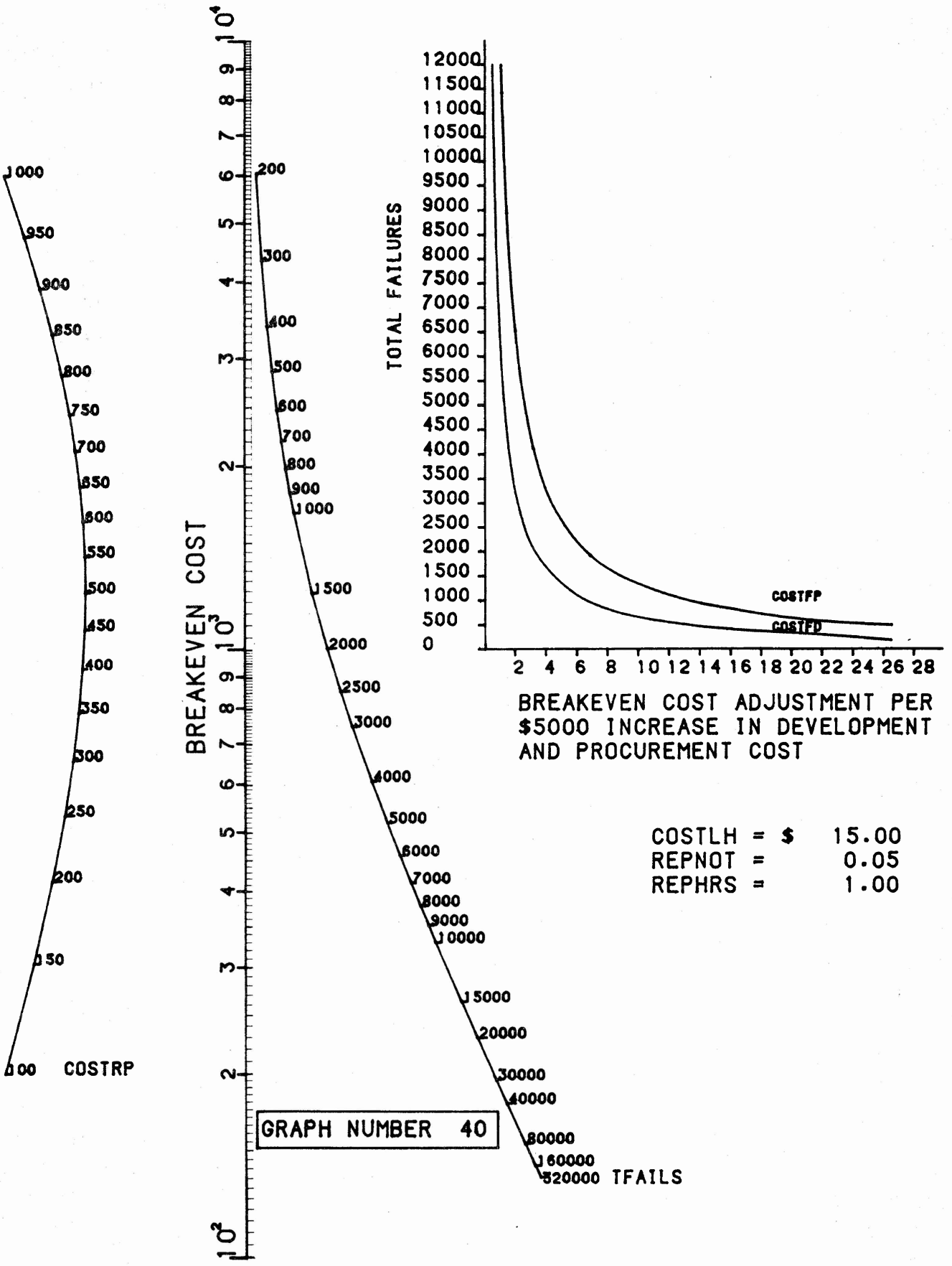
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.05
REPHRS = 0.50
GRAPH NUMBER 38


BREAKEVEN COST
TOTAL FAILURES
COSTRP
TFAILS
COSTFP
COSTFD
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.05
REPHRS = 0.75
GRAPH NUMBER 39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100 COSTRP
BREAKEVEN COST
10^4
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10^3
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10^2
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TOTAL FAILURES
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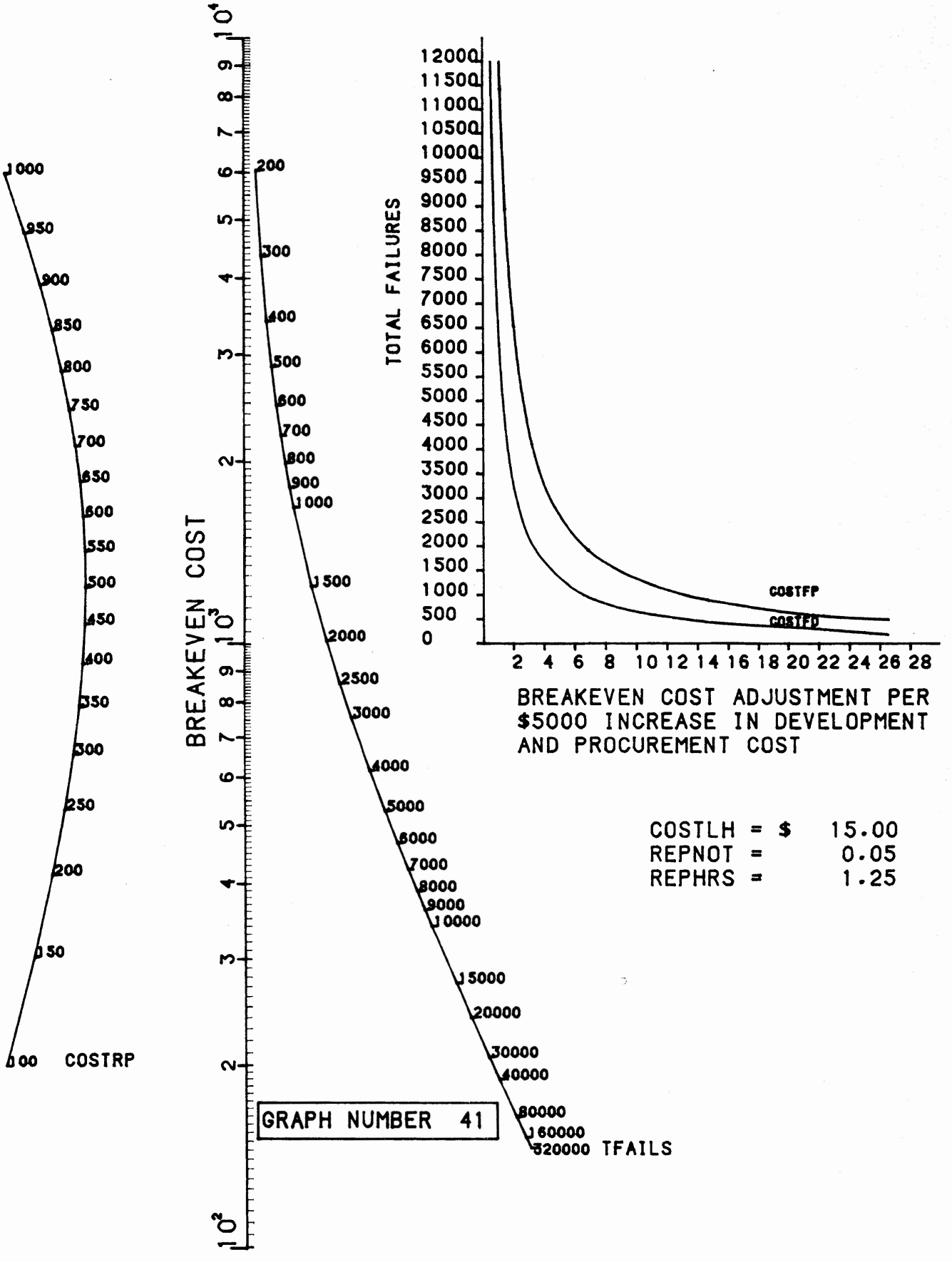
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.05
REPHRS = 1.00
GRAPH NUMBER 40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COSTRP
BREAKEVEN COST
10^4
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10^3
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5
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3
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10^2
200
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TOTAL FAILURES
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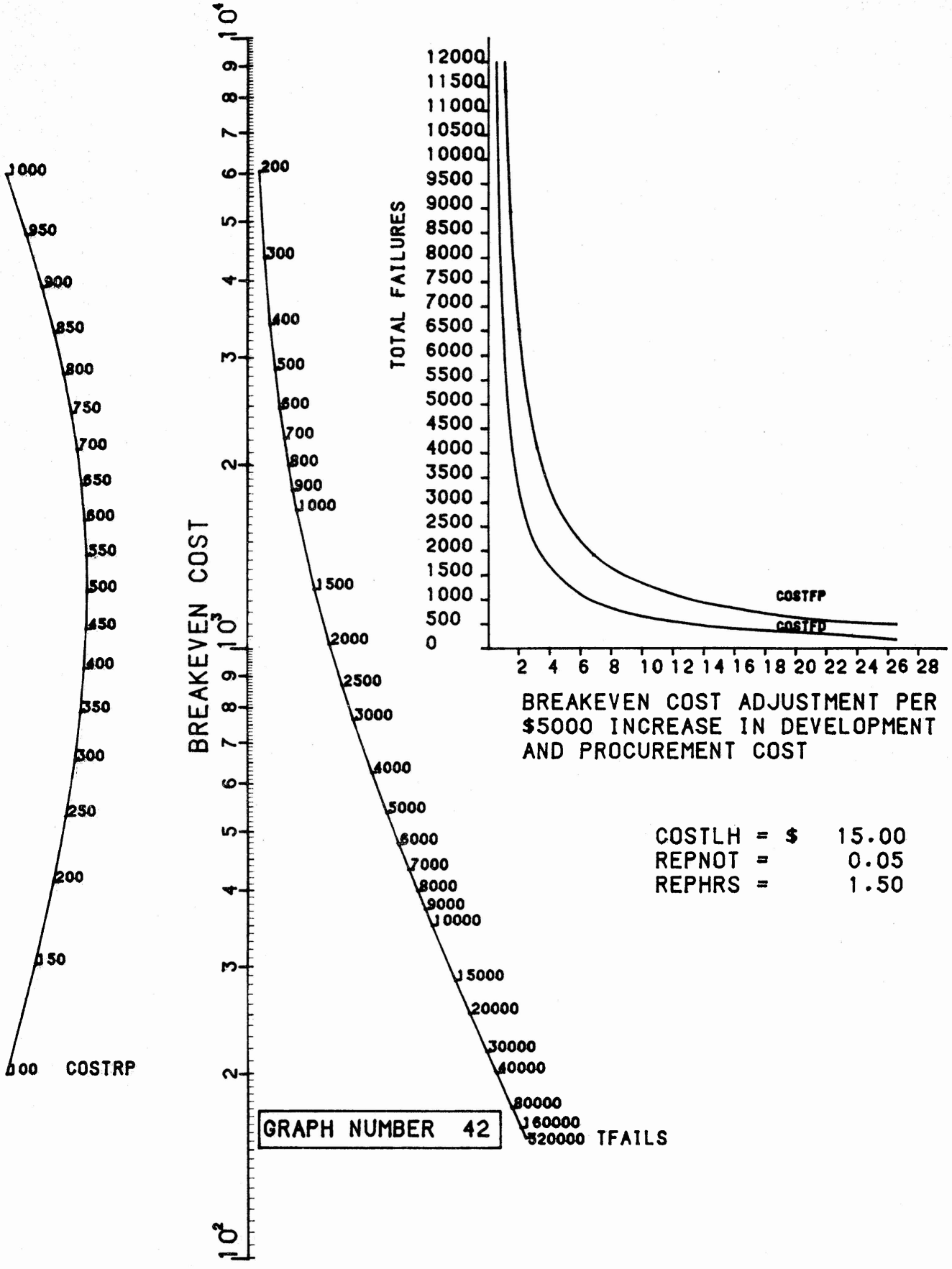
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.05
REPHRS = 1.25
GRAPH NUMBER 41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COSTRP
BREAKEVEN COST
10^4
9
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10^3
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8
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6
5
4
3
2
10^2
200
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TFAILS
TOTAL FAILURES
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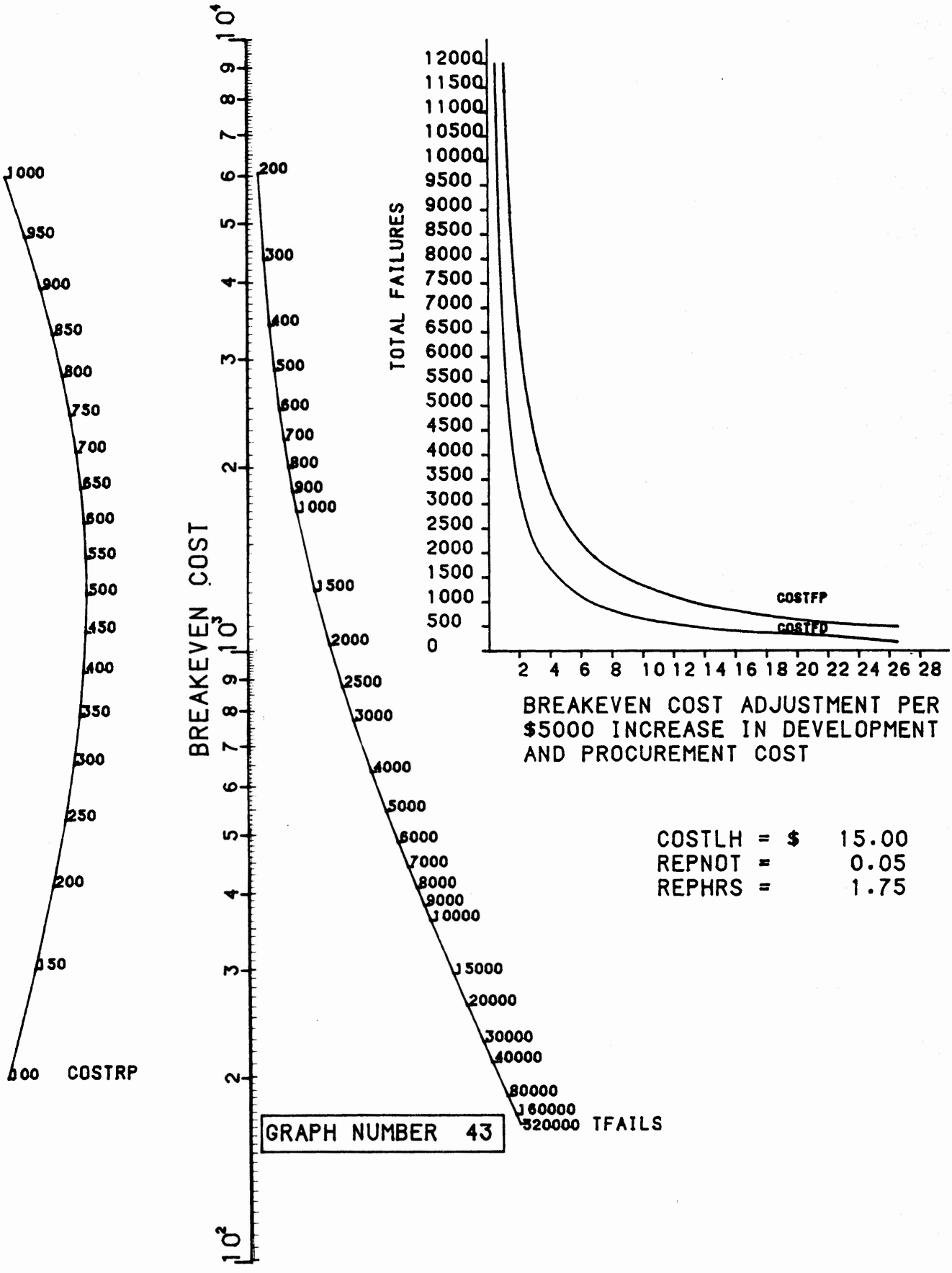
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.05
REPHRS = 1.50
GRAPH NUMBER 42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COSTRP
BREAKEVEN COST
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TFAILS
TOTAL FAILURES
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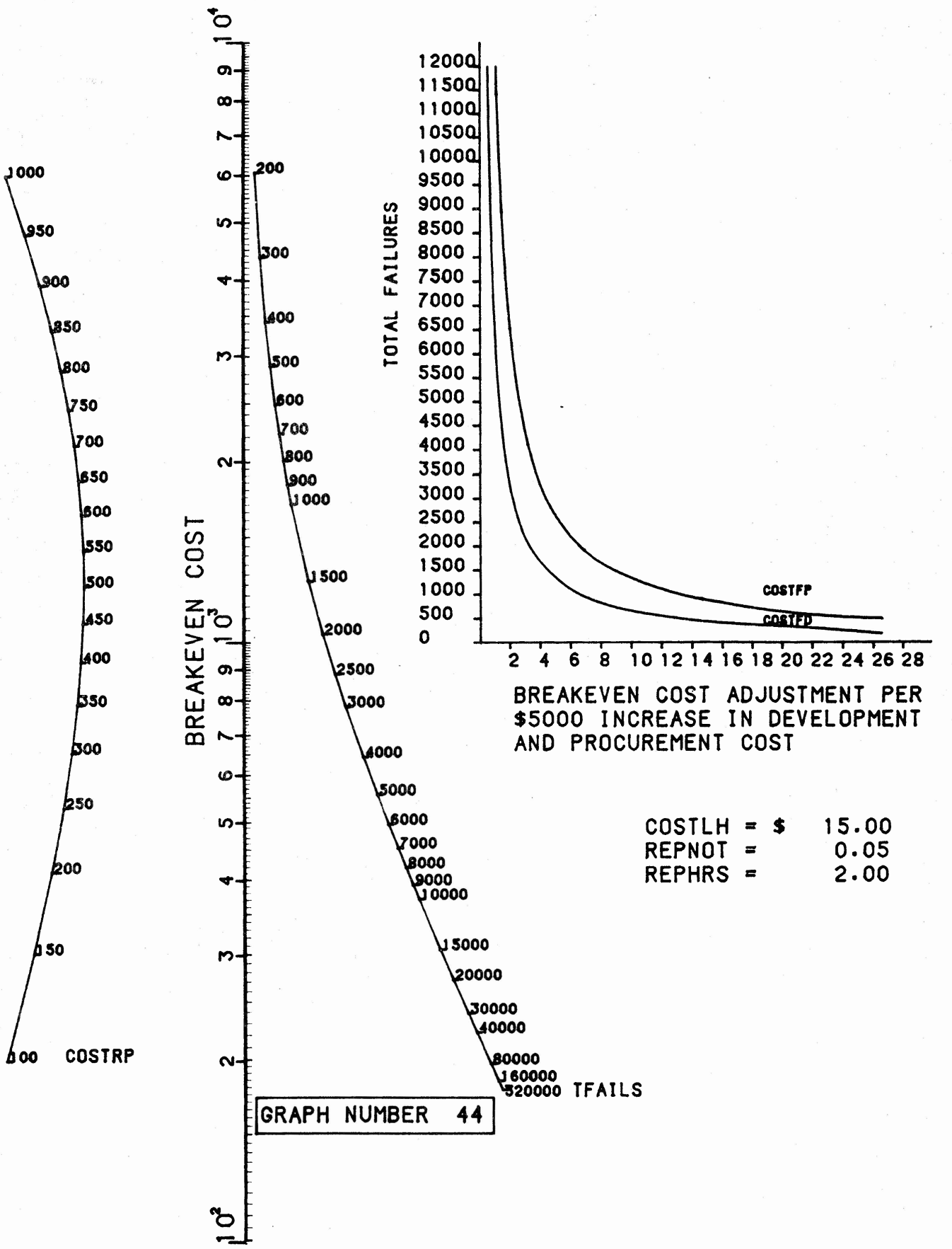
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.05
REPHRS = 1.75
GRAPH NUMBER 43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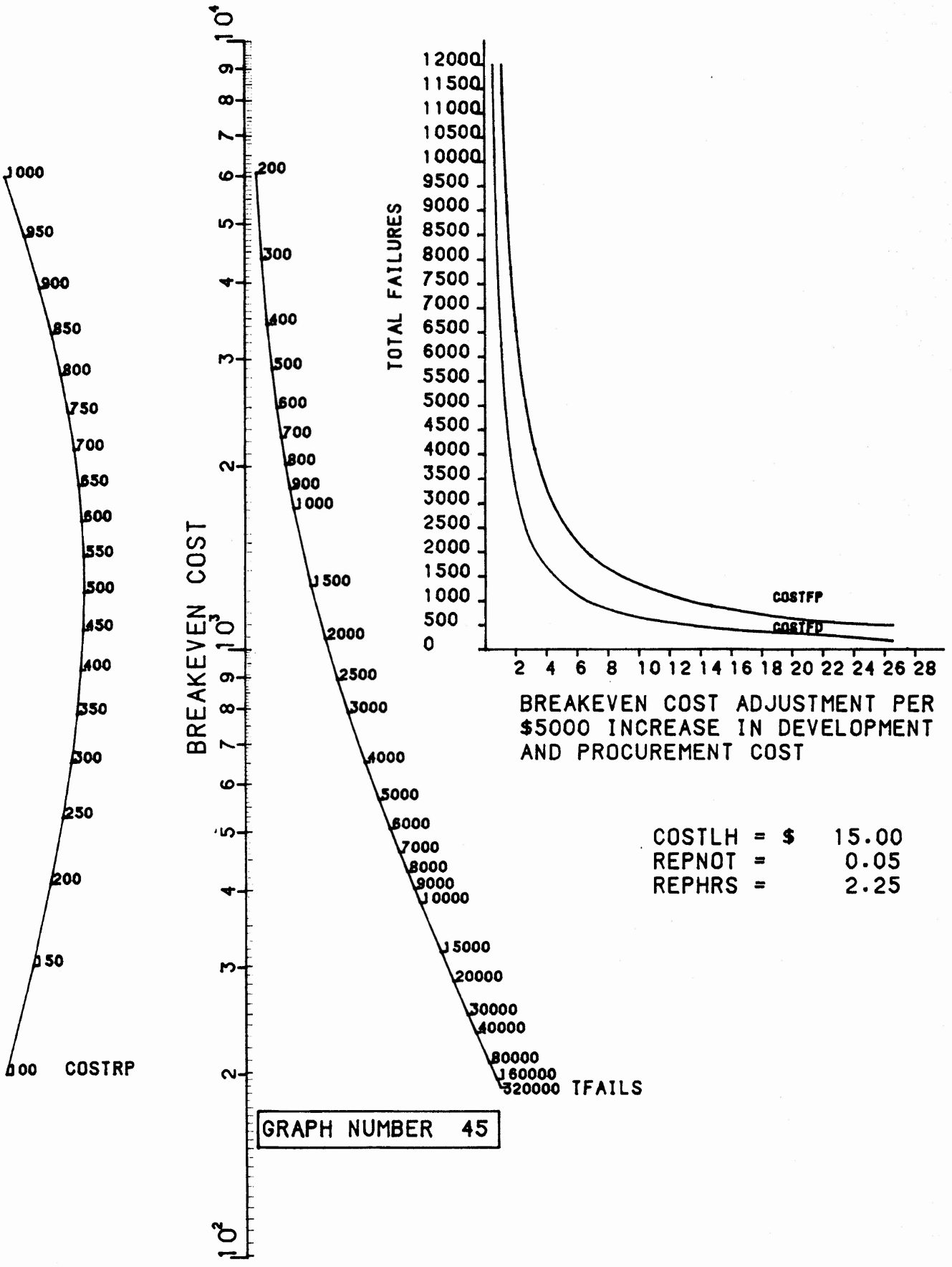
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.05
REPHRS = 2.00
GRAPH NUMBER 44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COSTRP
BREAKEVEN COST
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10^2
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TFAILS
TOTAL FAILURES
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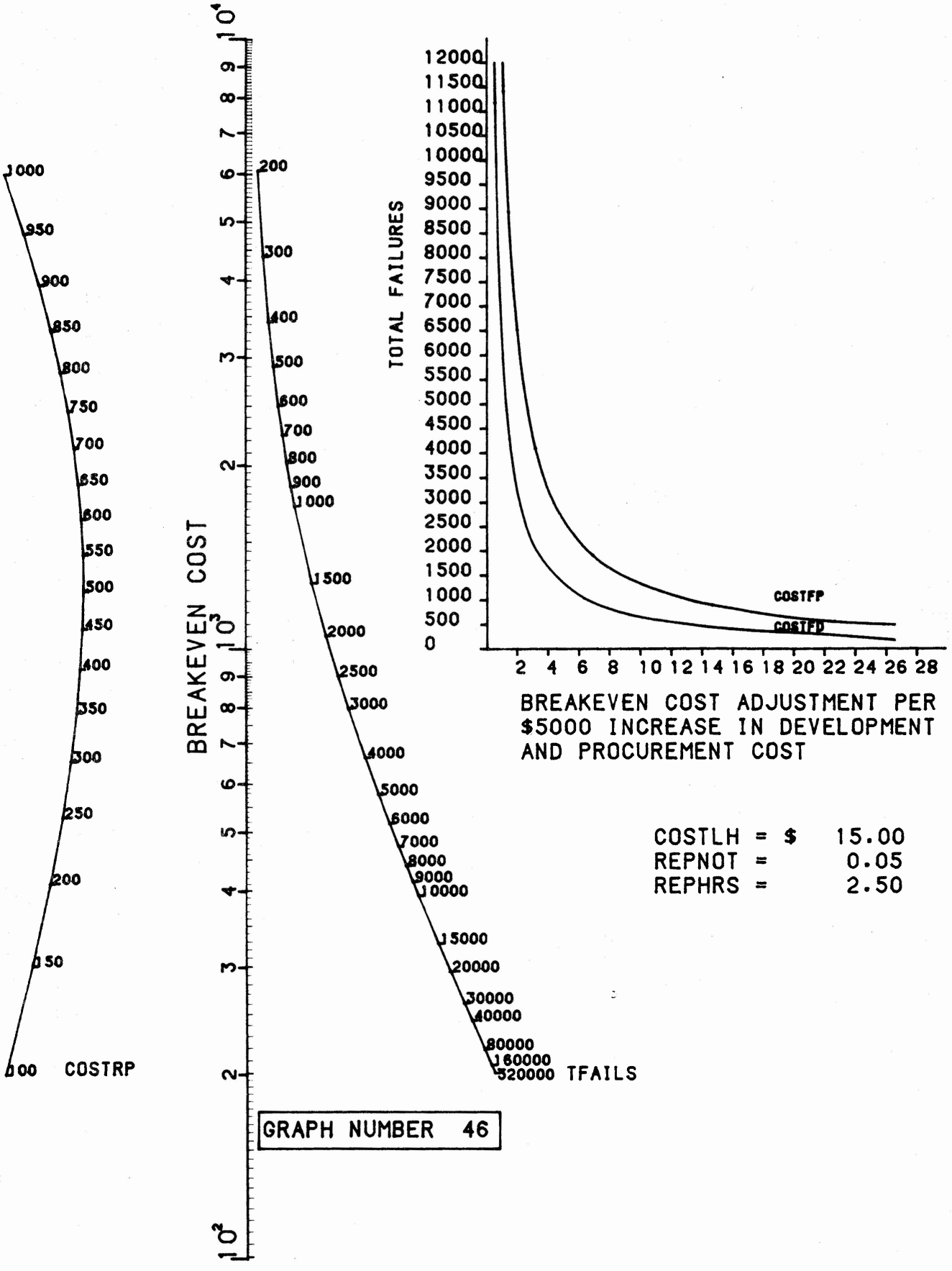
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.05
REPHRS = 2.25
GRAPH NUMBER 45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TOTAL FAILURES
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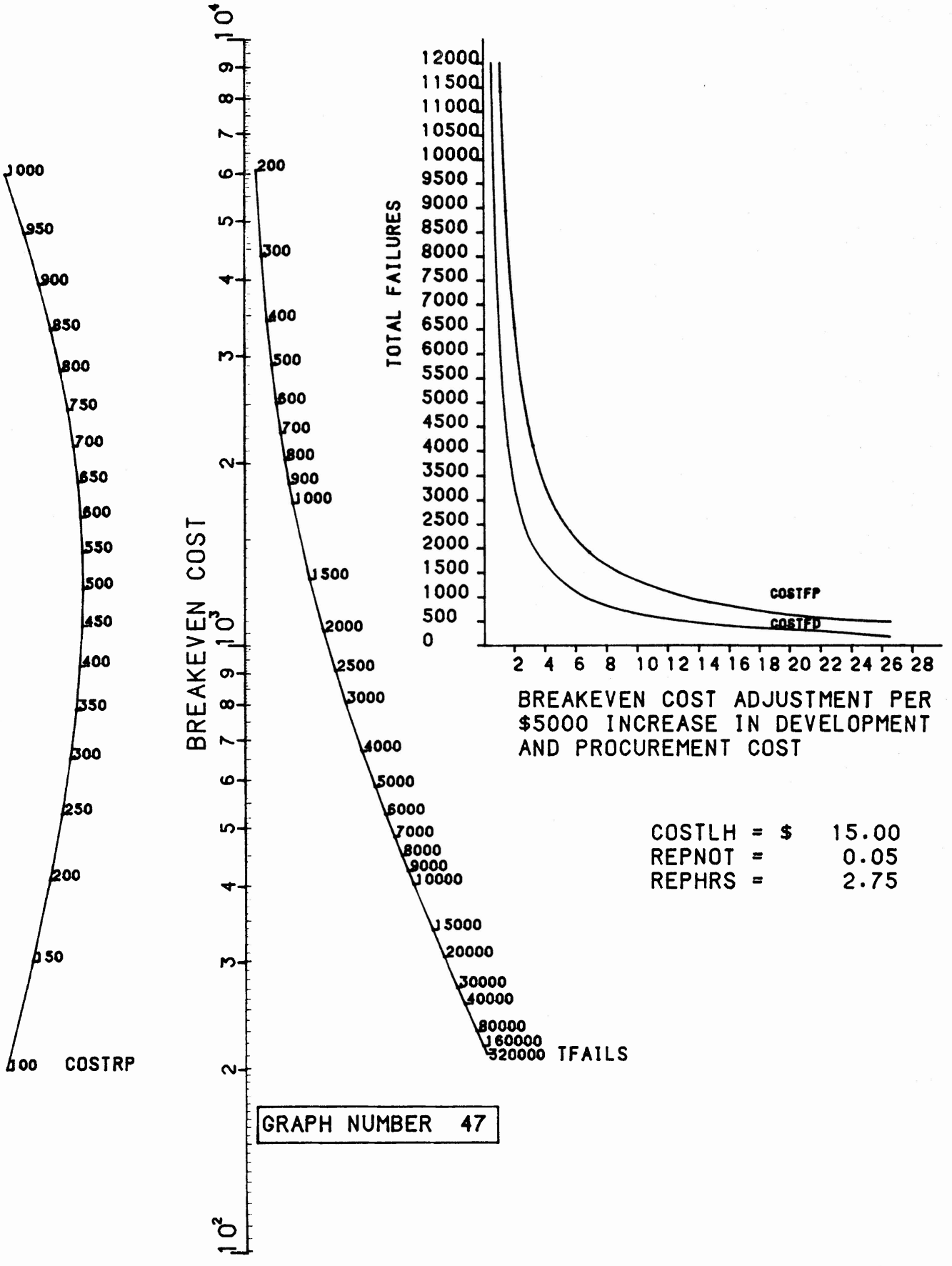
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.05
REPHRS = 2.50
GRAPH NUMBER 46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TOTAL FAILURES
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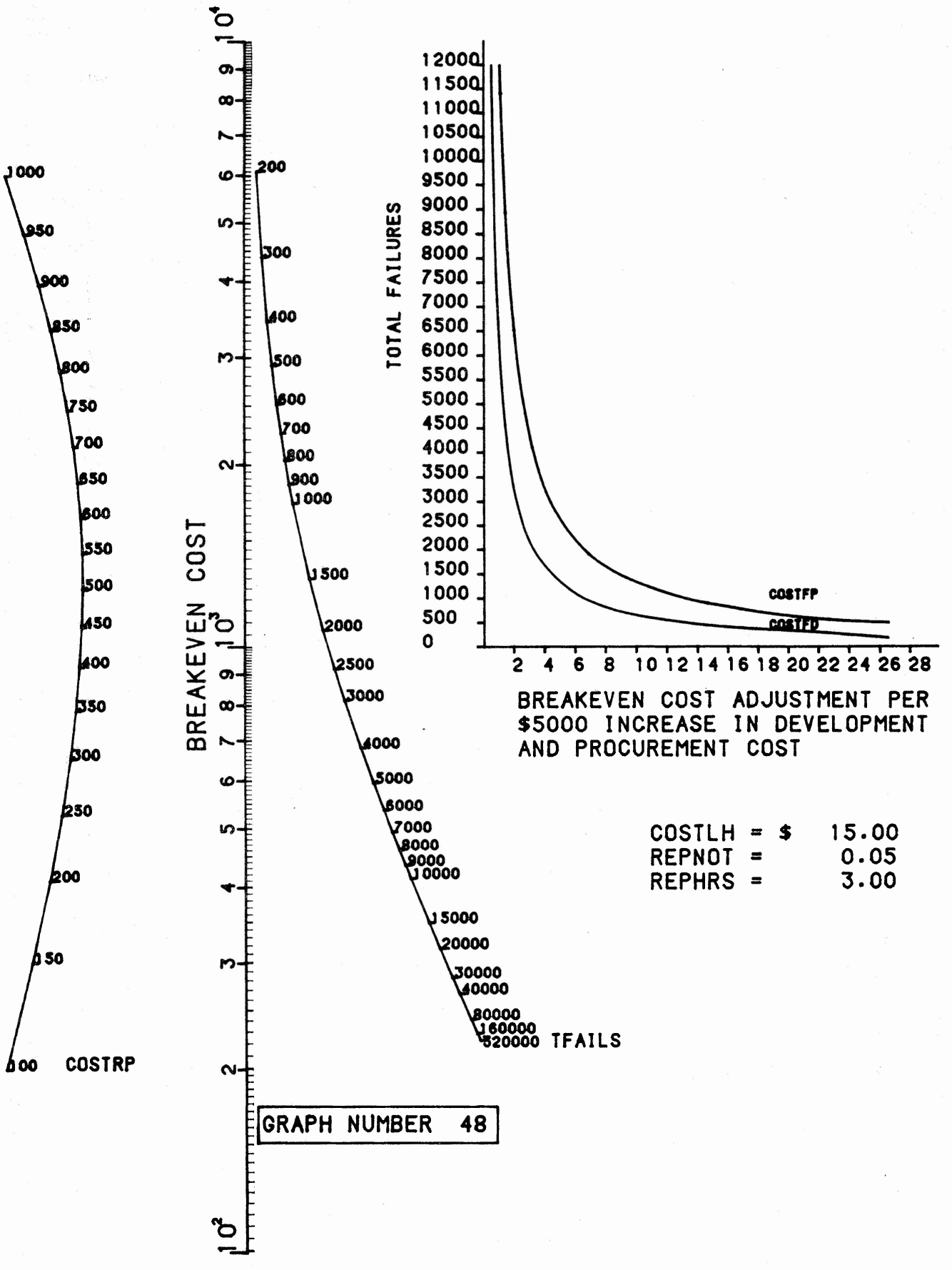
0
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.05
REPHRS = 2.75
GRAPH NUMBER 47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COSTRP
BREAKEVEN COST
200
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TFAILS
TOTAL FAILURES
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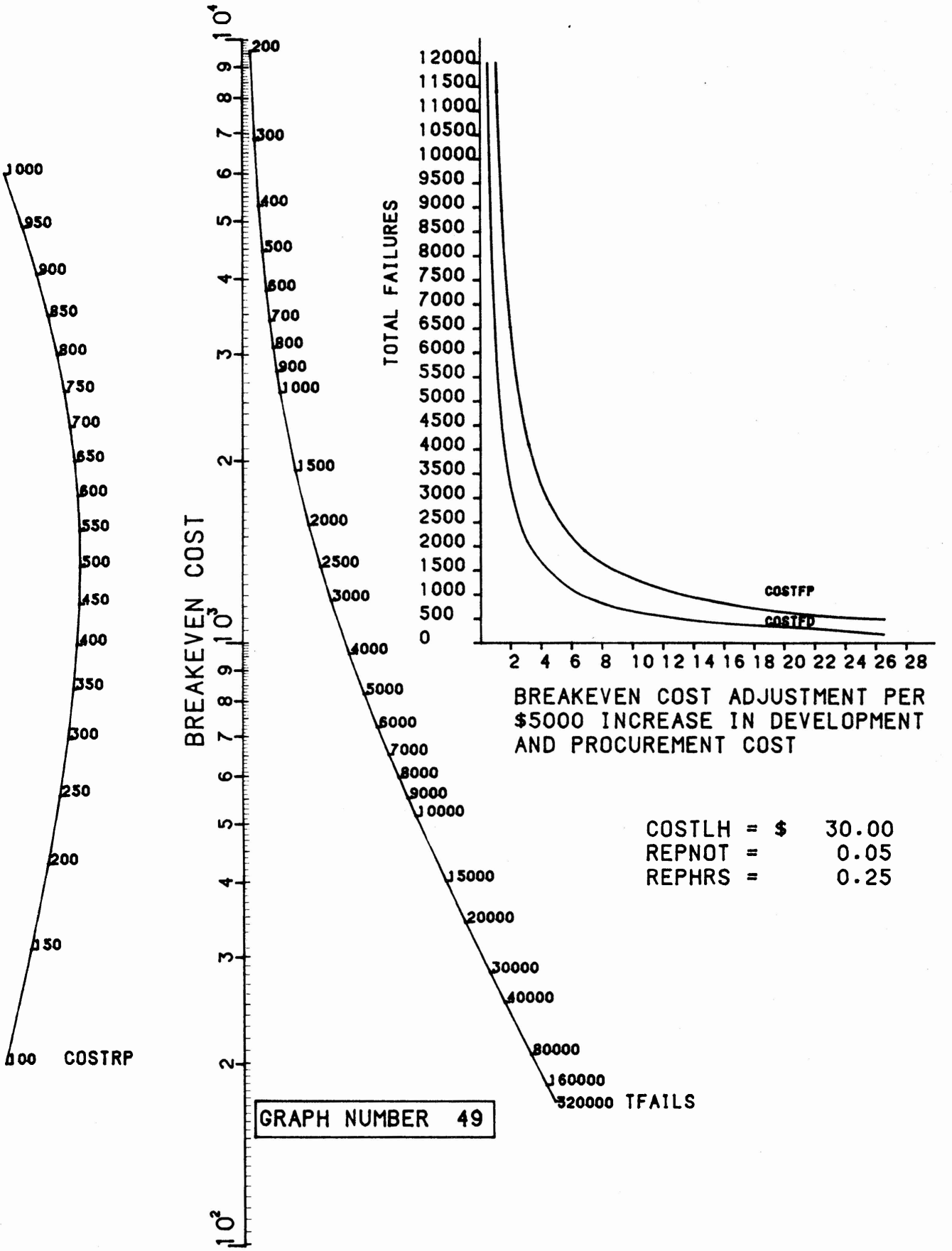
0
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 15.00
REPNOT = 0.05
REPHRS = 3.00
GRAPH NUMBER 48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COSTRP
BREAKEVEN COST
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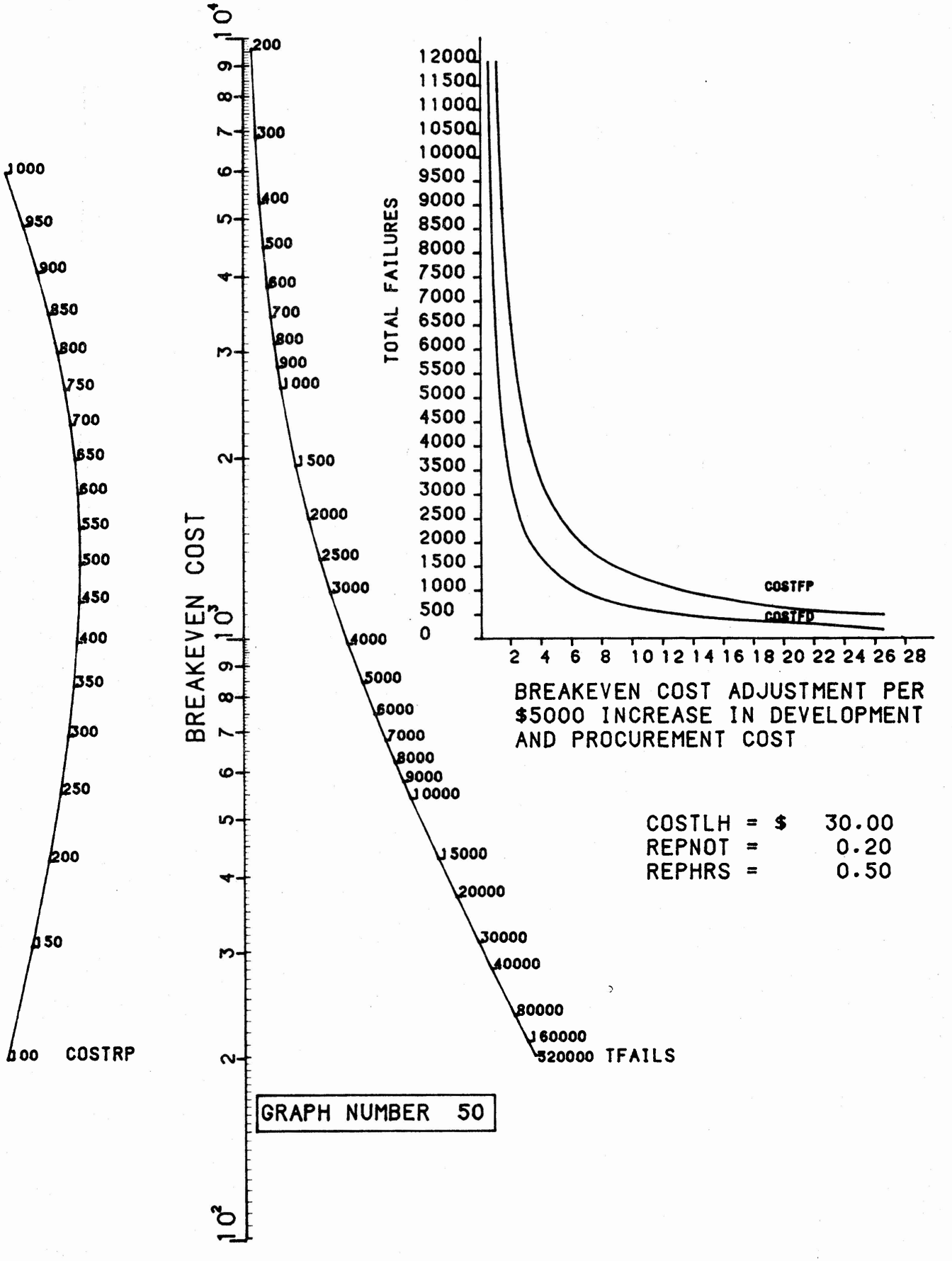
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.05
REPHRS = 0.25
GRAPH NUMBER 49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COSTRP
BREAKEVEN COST
10^4
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10^3
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TFAILS
TOTAL FAILURES
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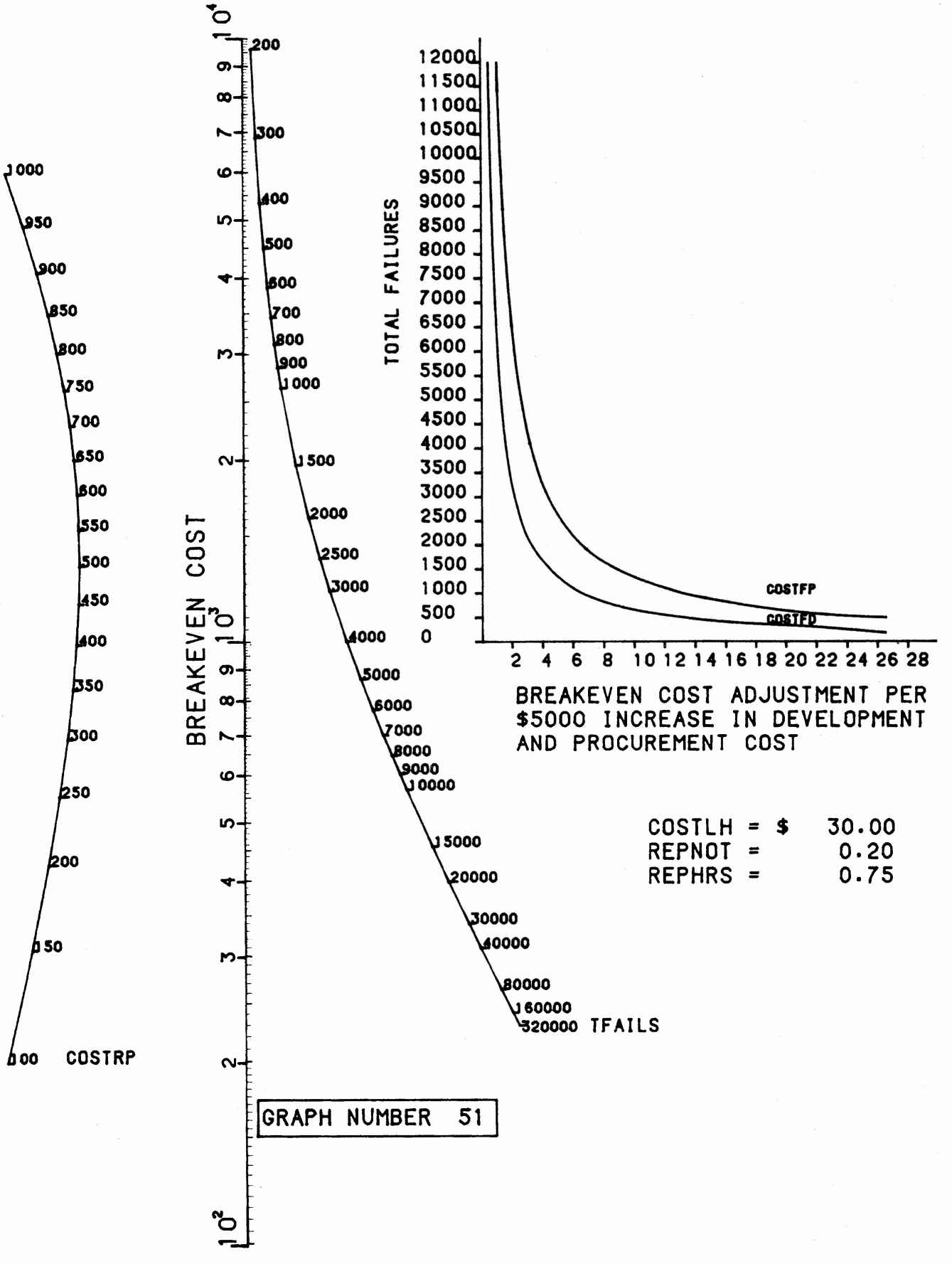
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.20
REPHRS = 0.50
GRAPH NUMBER 50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COSTRP
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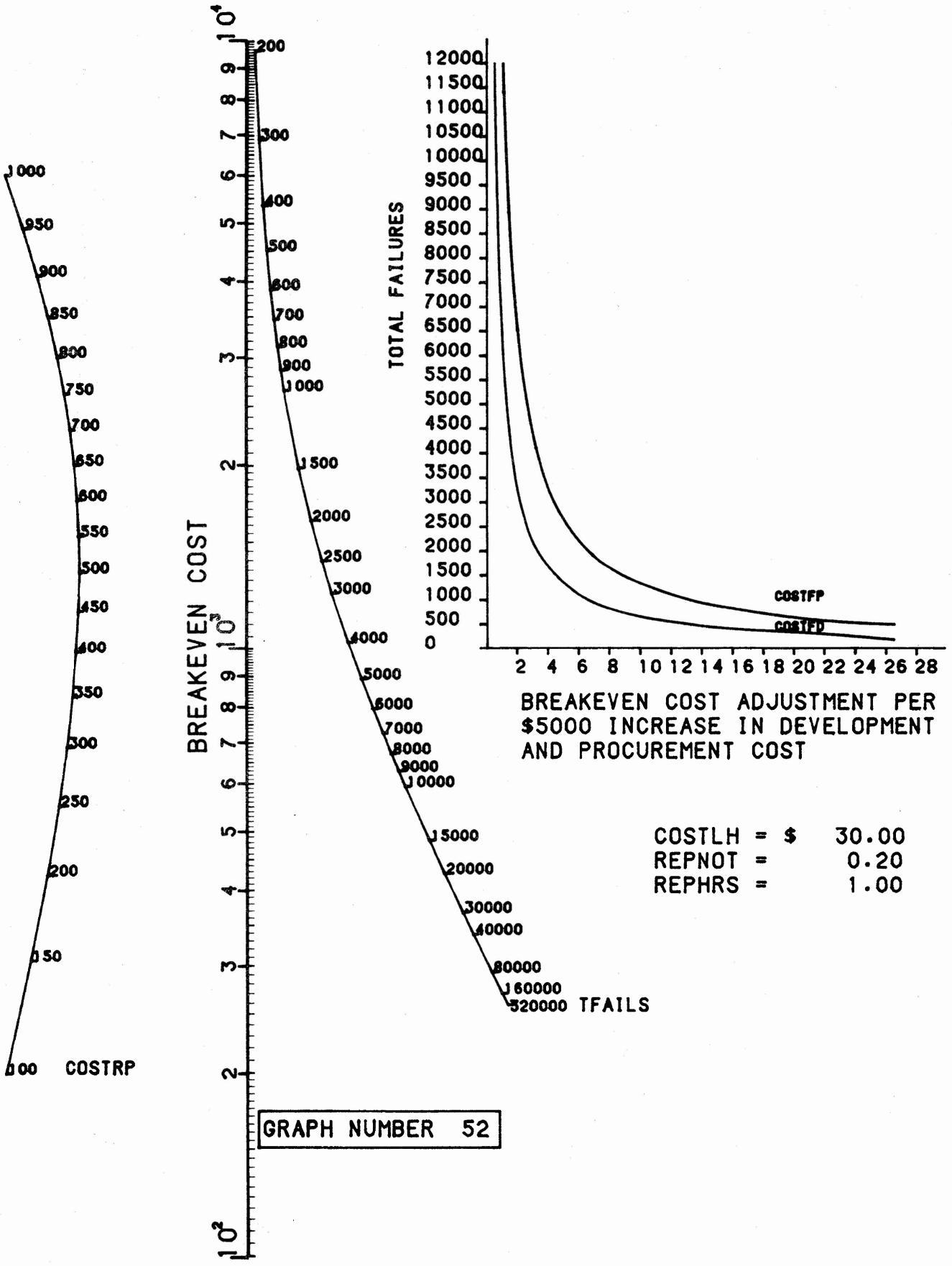
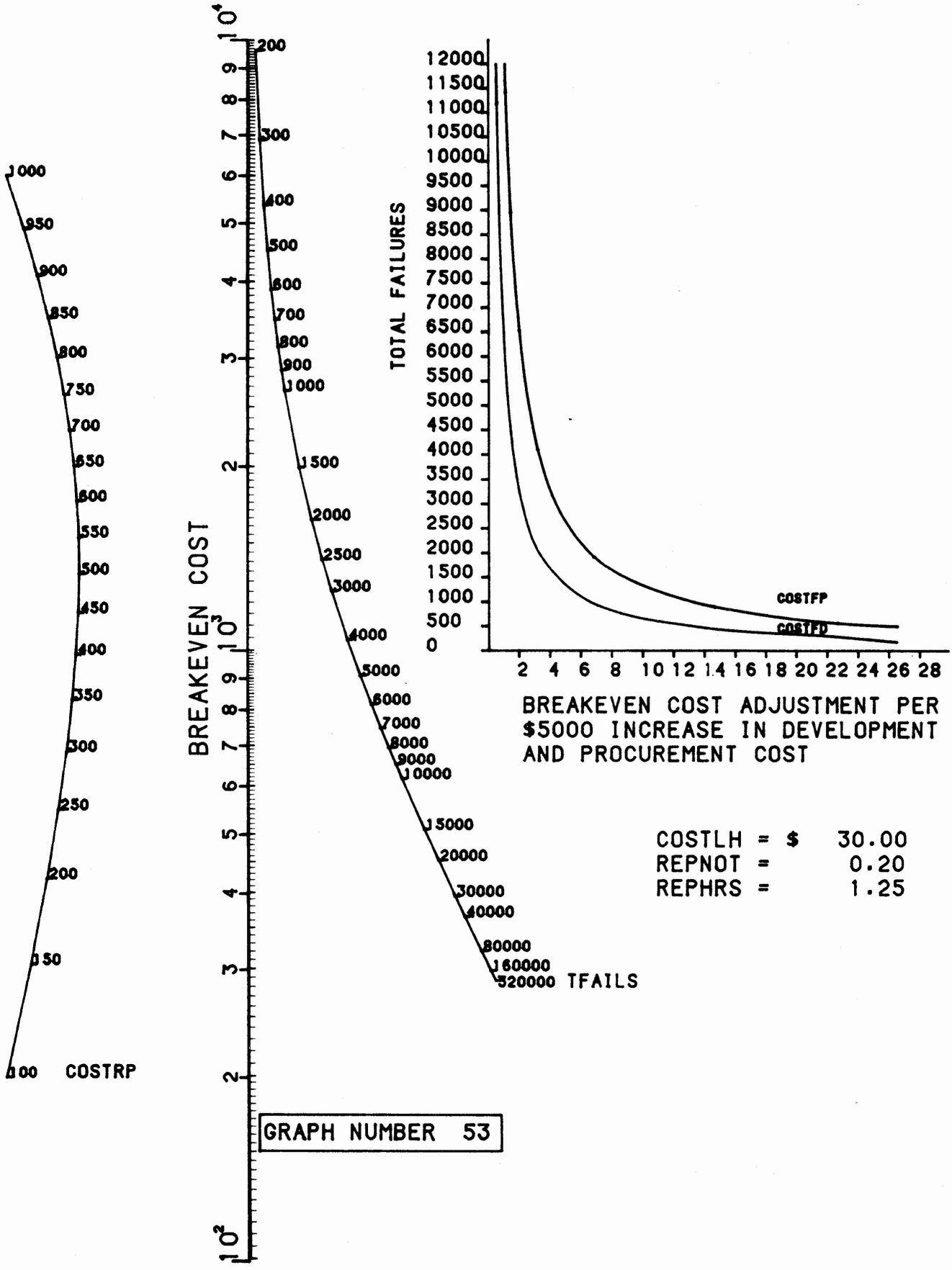
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.20
REPHRS = 0.75
GRAPH NUMBER 51


BREAKEVEN COST
TOTAL FAILURES
COSTRP
TFAILS
COSTFP
COSTFD
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.20
REPHRS = 1.00
GRAPH NUMBER 52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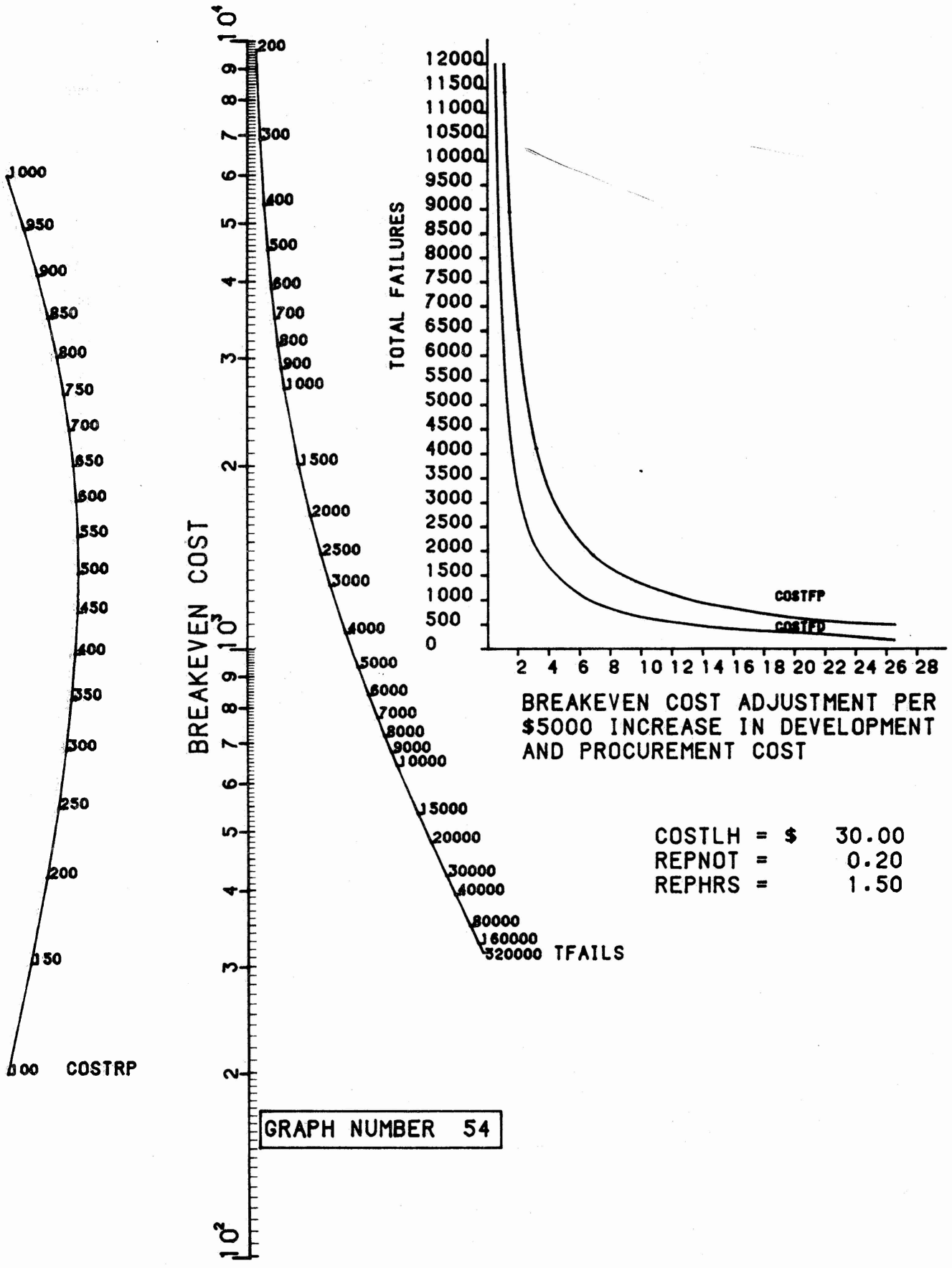
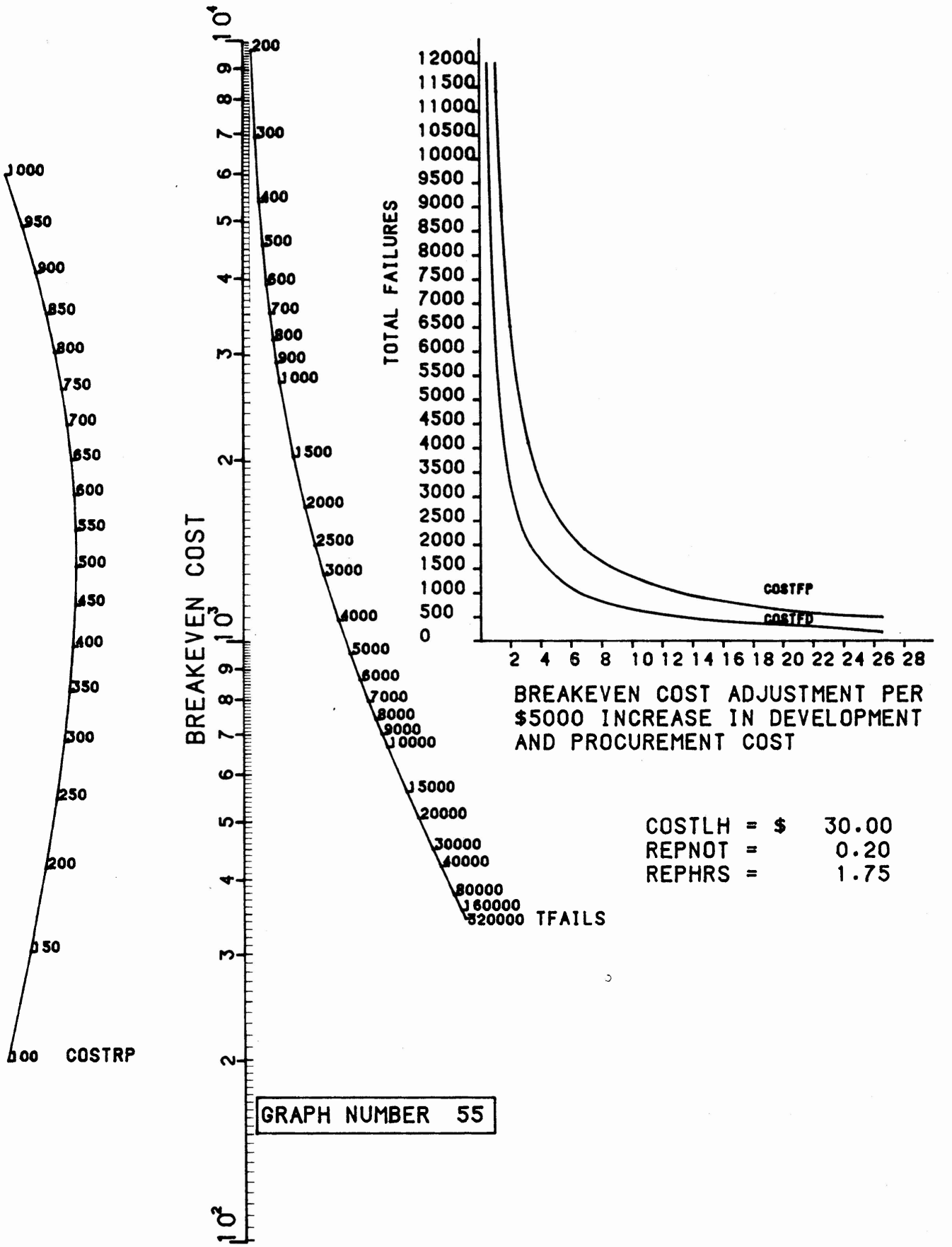
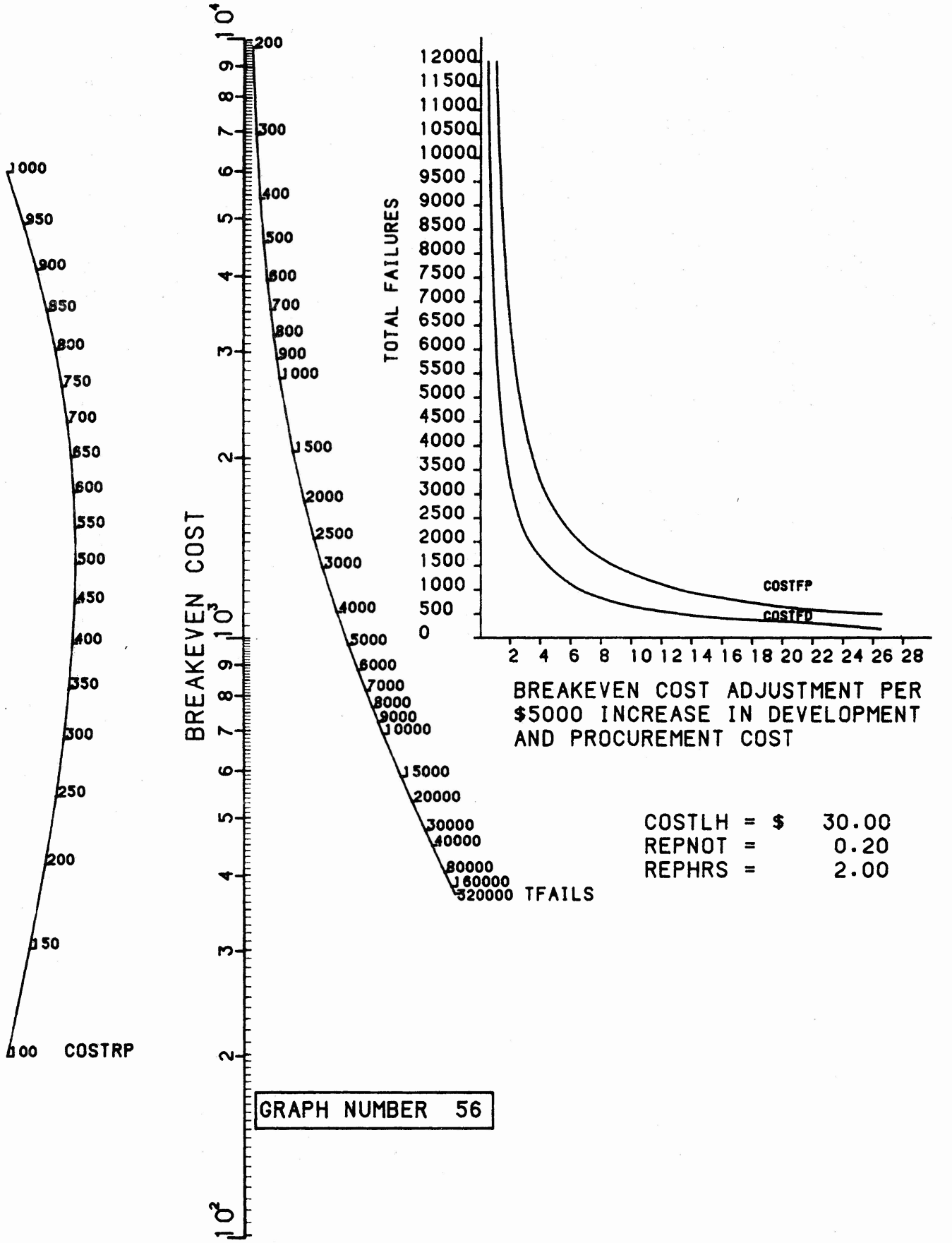
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.20
REPHRS = 1.25
GRAPH NUMBER 53


BREAKEVEN COST
TOTAL FAILURES
COSTRP
TFAILS
COSTFP
COSTFD
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.20
REPHRS = 1.50
GRAPH NUMBER 54


BREAKEVEN COST
TOTAL FAILURES
COSTRP
TFAILS
COSTFP
COSTFD
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.20
REPHRS = 1.75
GRAPH NUMBER 55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COSTRP
BREAKEVEN COST
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TFAILS
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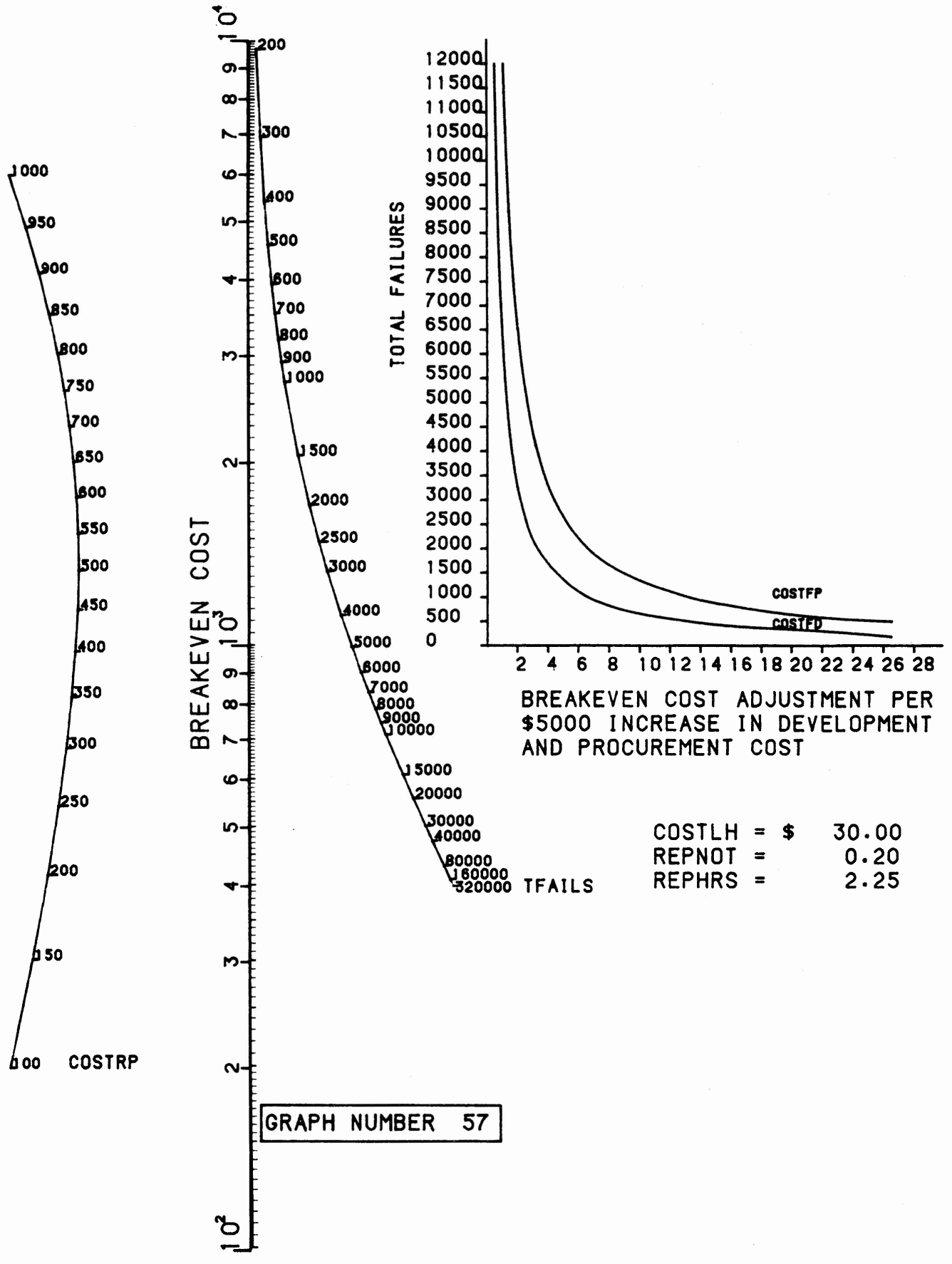
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.20
REPHRS = 2.00
GRAPH NUMBER 56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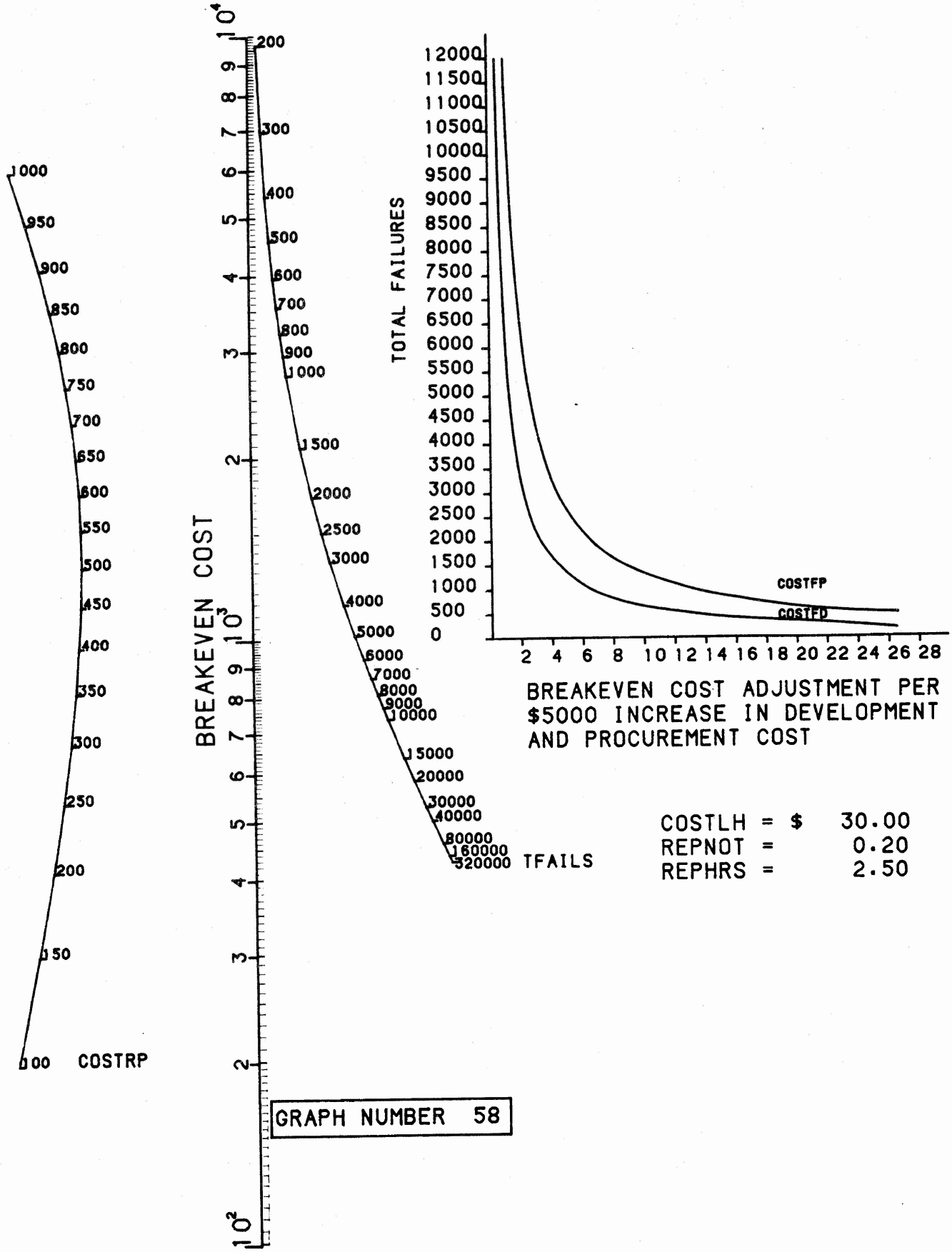
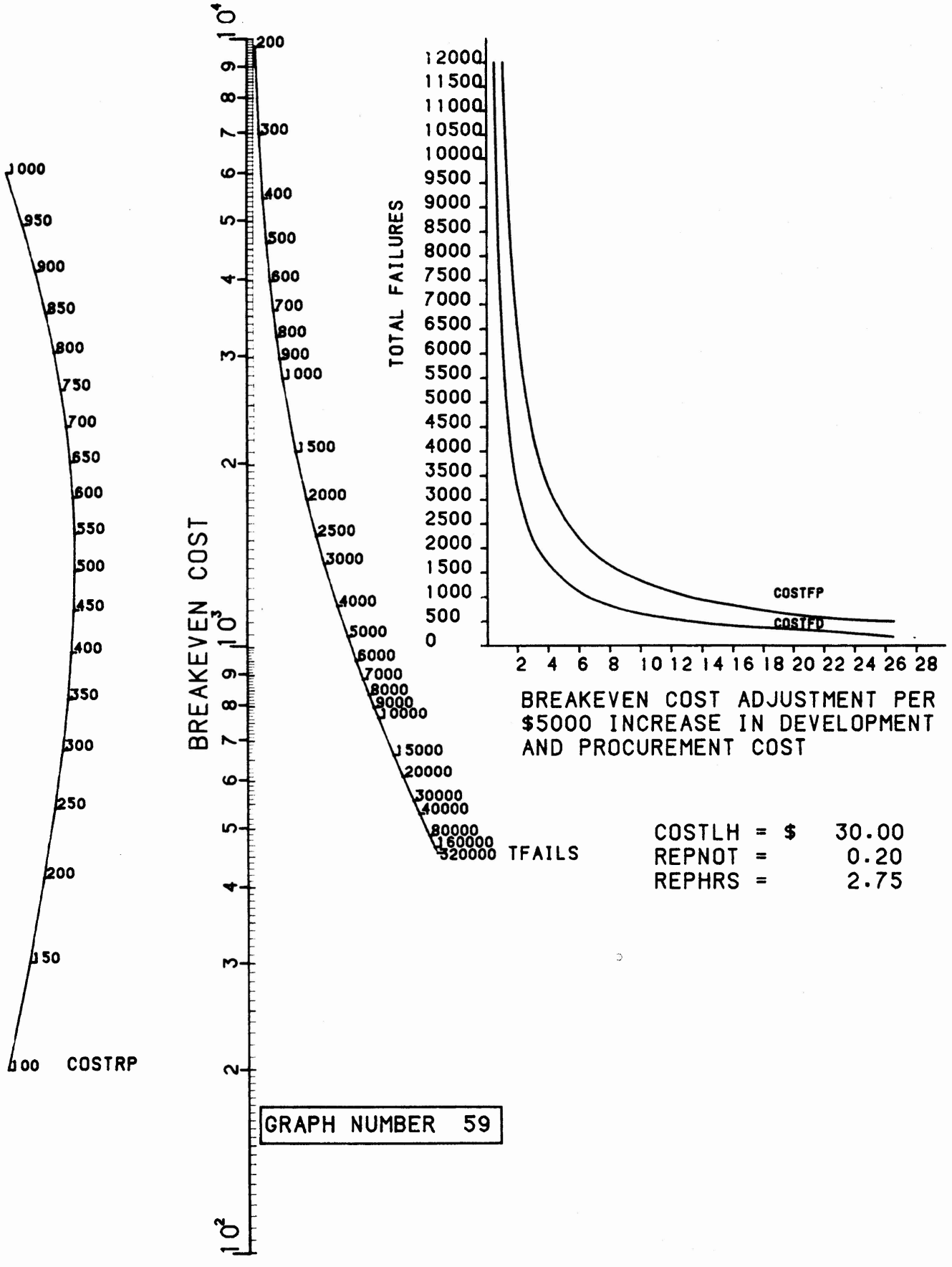
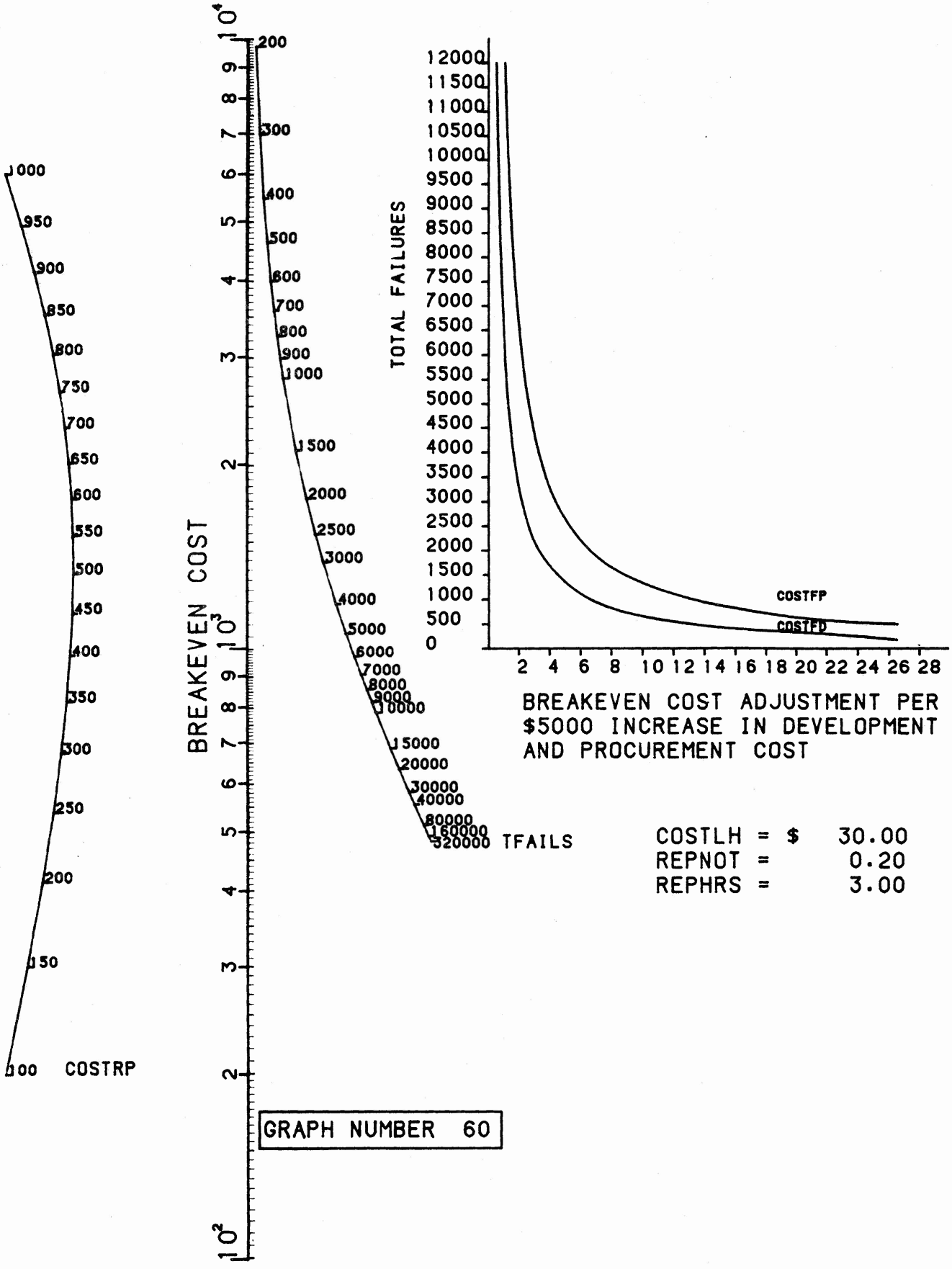
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.20
REPHRS = 2.25
GRAPH NUMBER 57


BREAKEVEN COST
TOTAL FAILURES
COSTRP
TFAILS
COSTFP
COSTFD
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.20
REPHRS = 2.50
GRAPH NUMBER 58


BREAKEVEN COST
TOTAL FAILURES
COSTRP
TFAILS
COSTFP
COSTFD
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.20
REPHRS = 2.75
GRAPH NUMBER 59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COSTRP
BREAKEVEN COST
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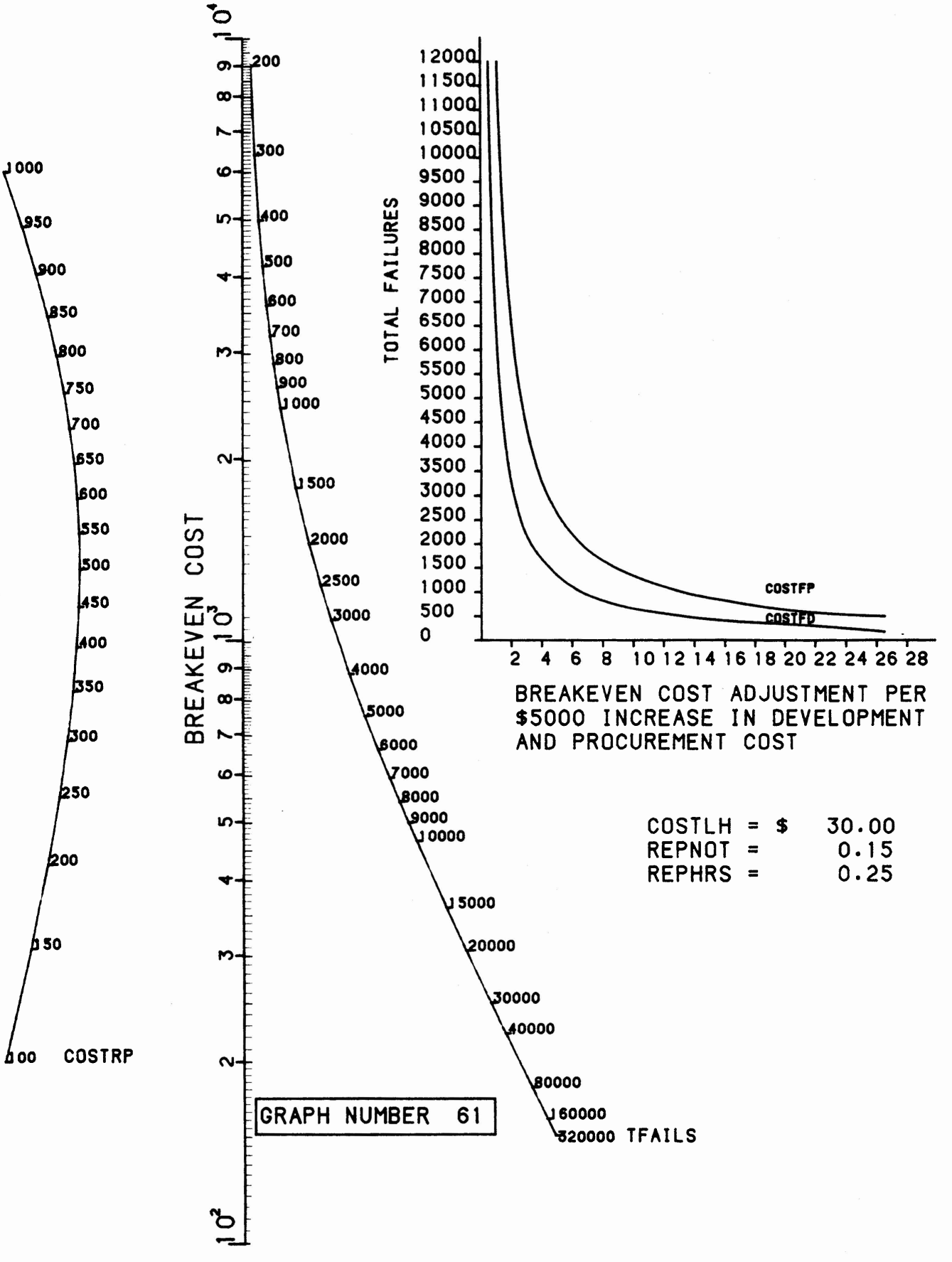
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.20
REPHRS = 3.00
GRAPH NUMBER 60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COSTRP
BREAKEVEN COST
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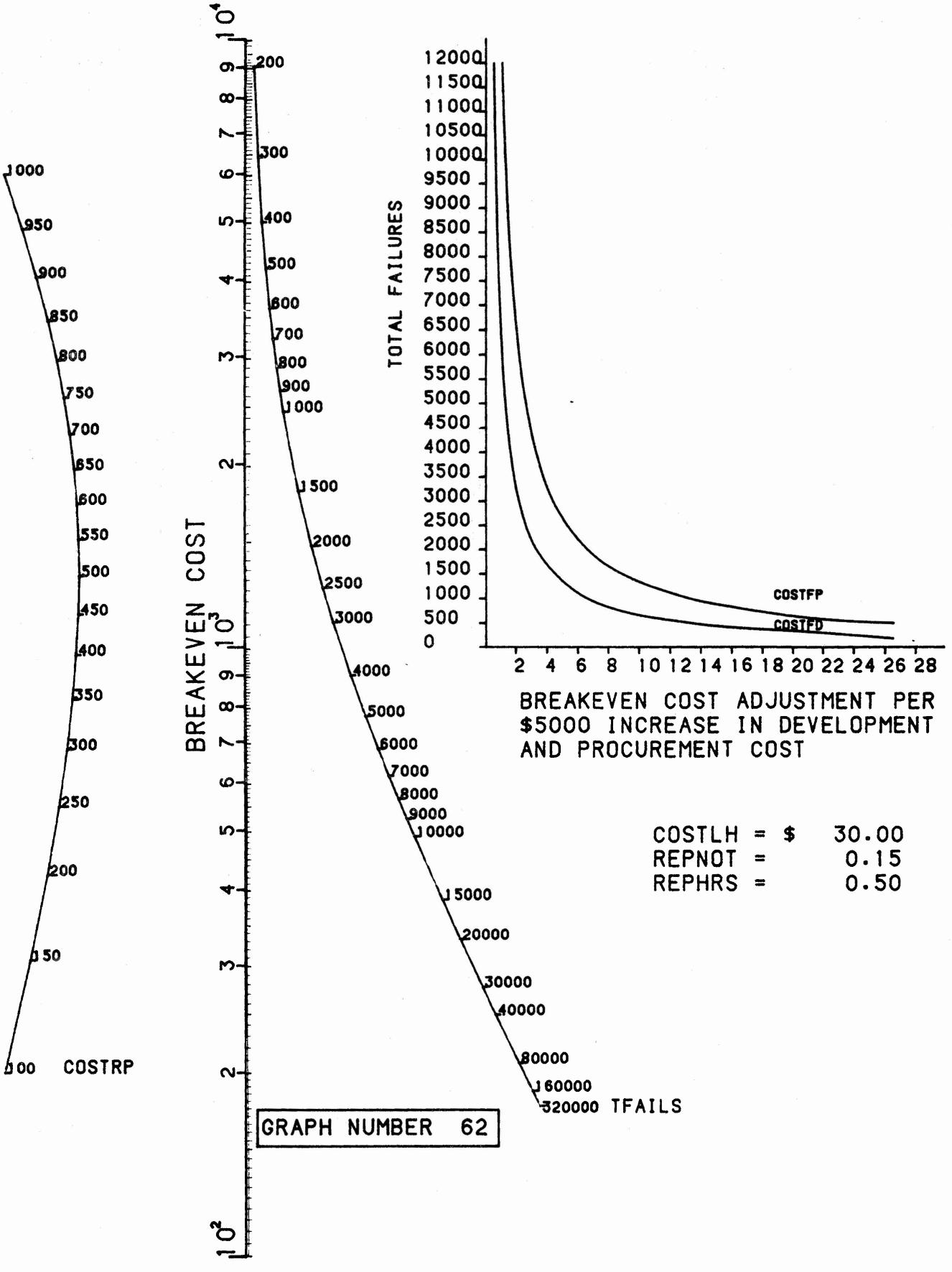
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.15
REPHRS = 0.25
GRAPH NUMBER 61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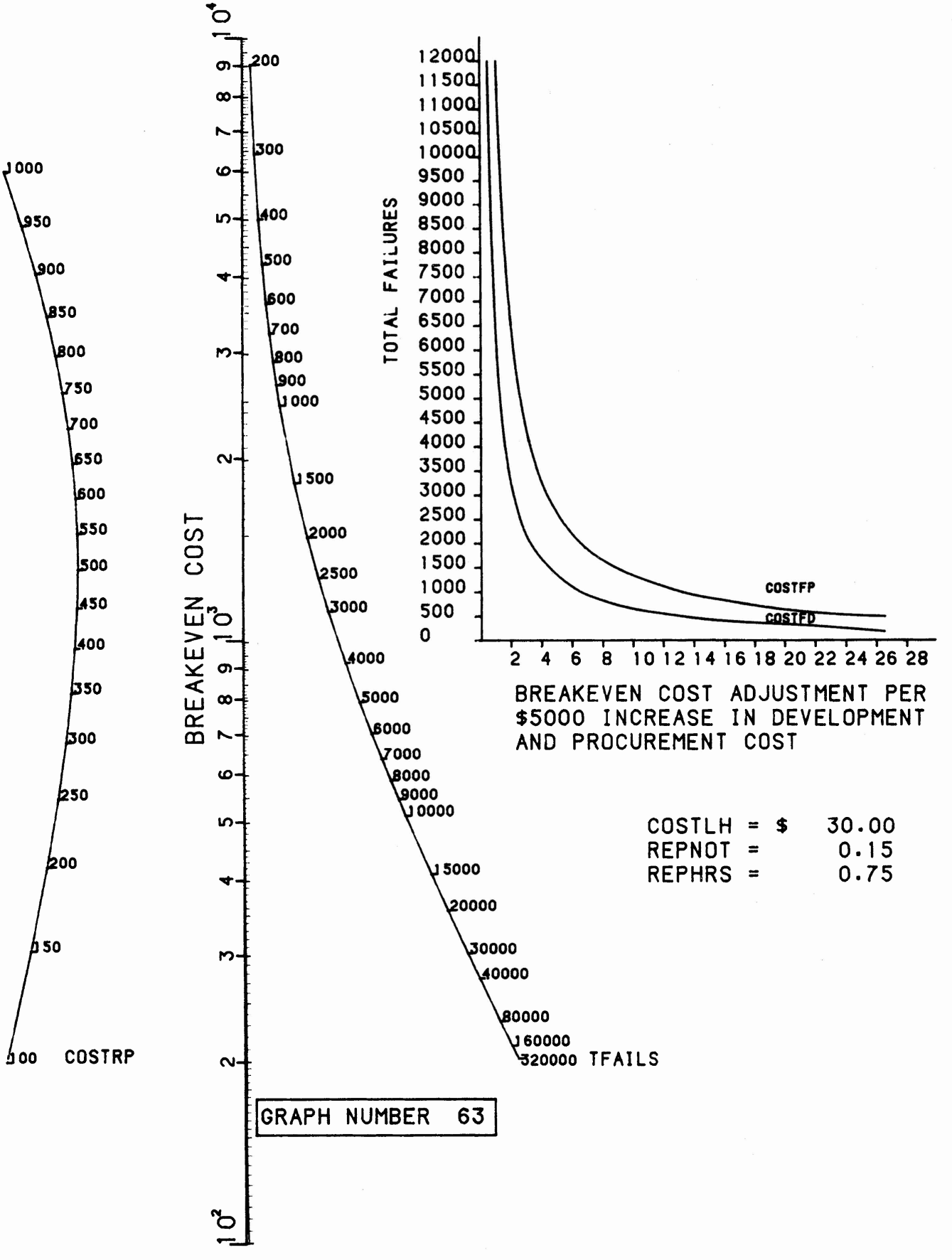
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.15
REPHRS = 0.50
GRAPH NUMBER 62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BREAKEVEN COST
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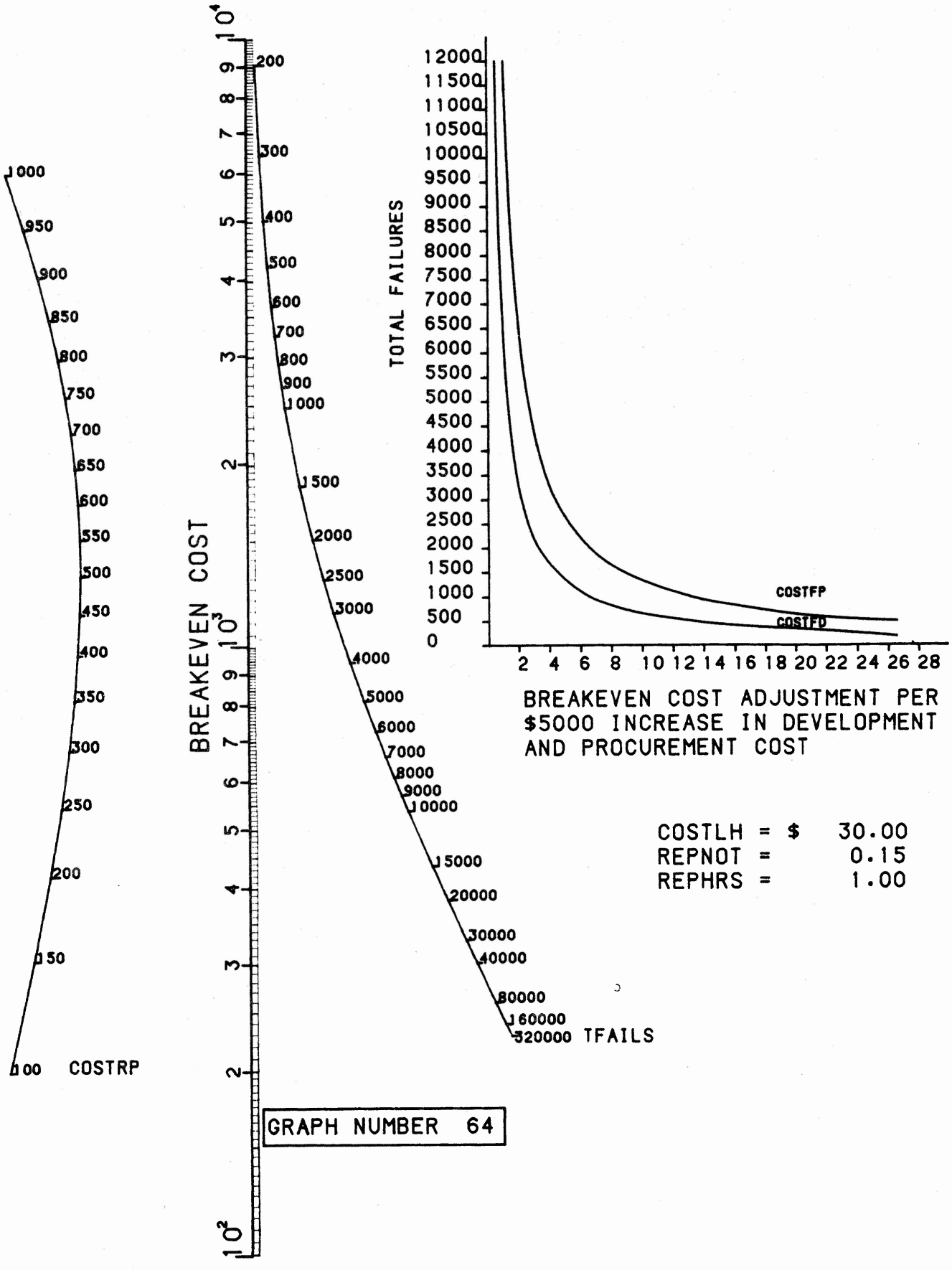
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.15
REPHRS = 0.75
GRAPH NUMBER 63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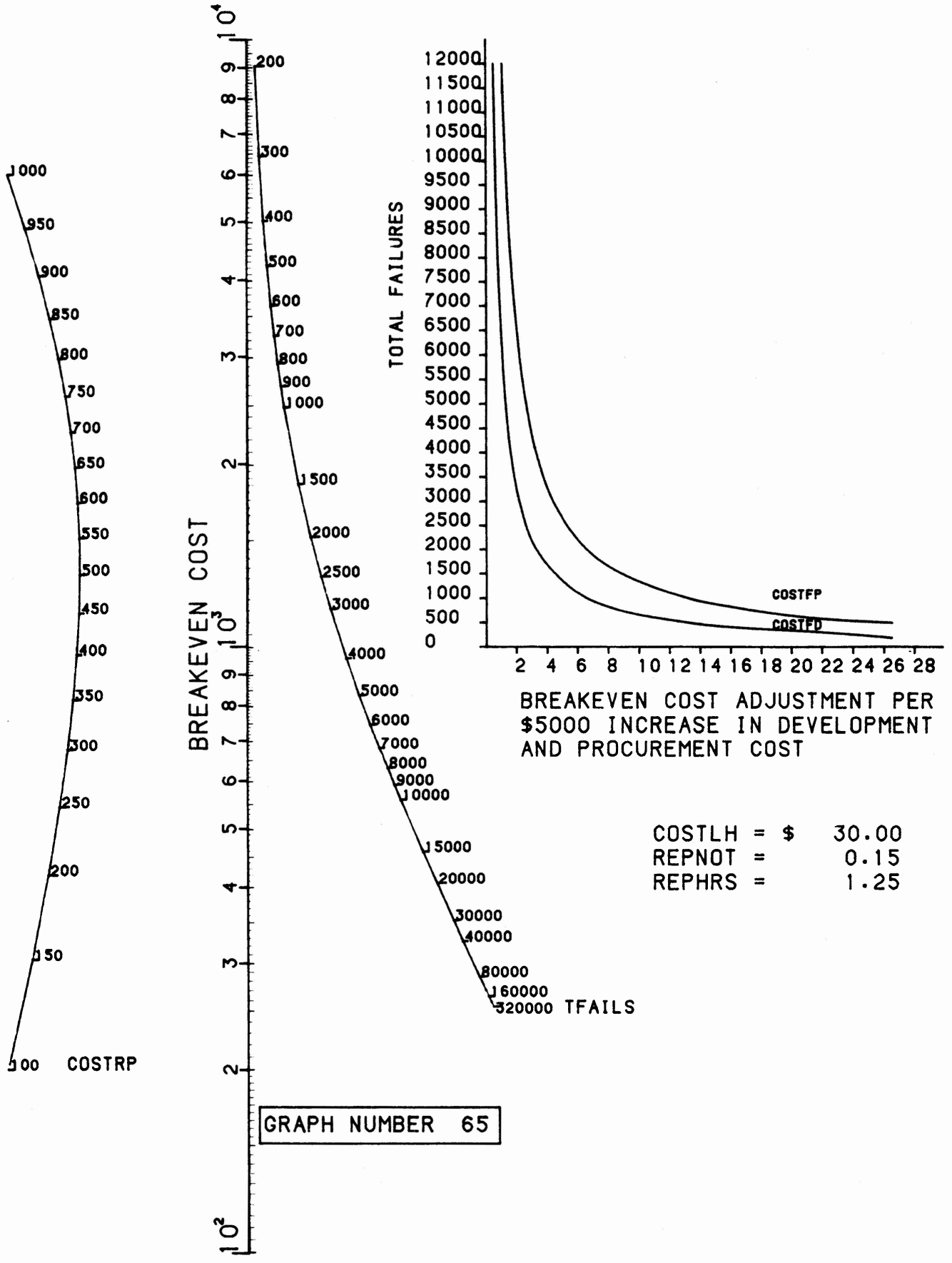
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.15
REPHRS = 1.00
GRAPH NUMBER 64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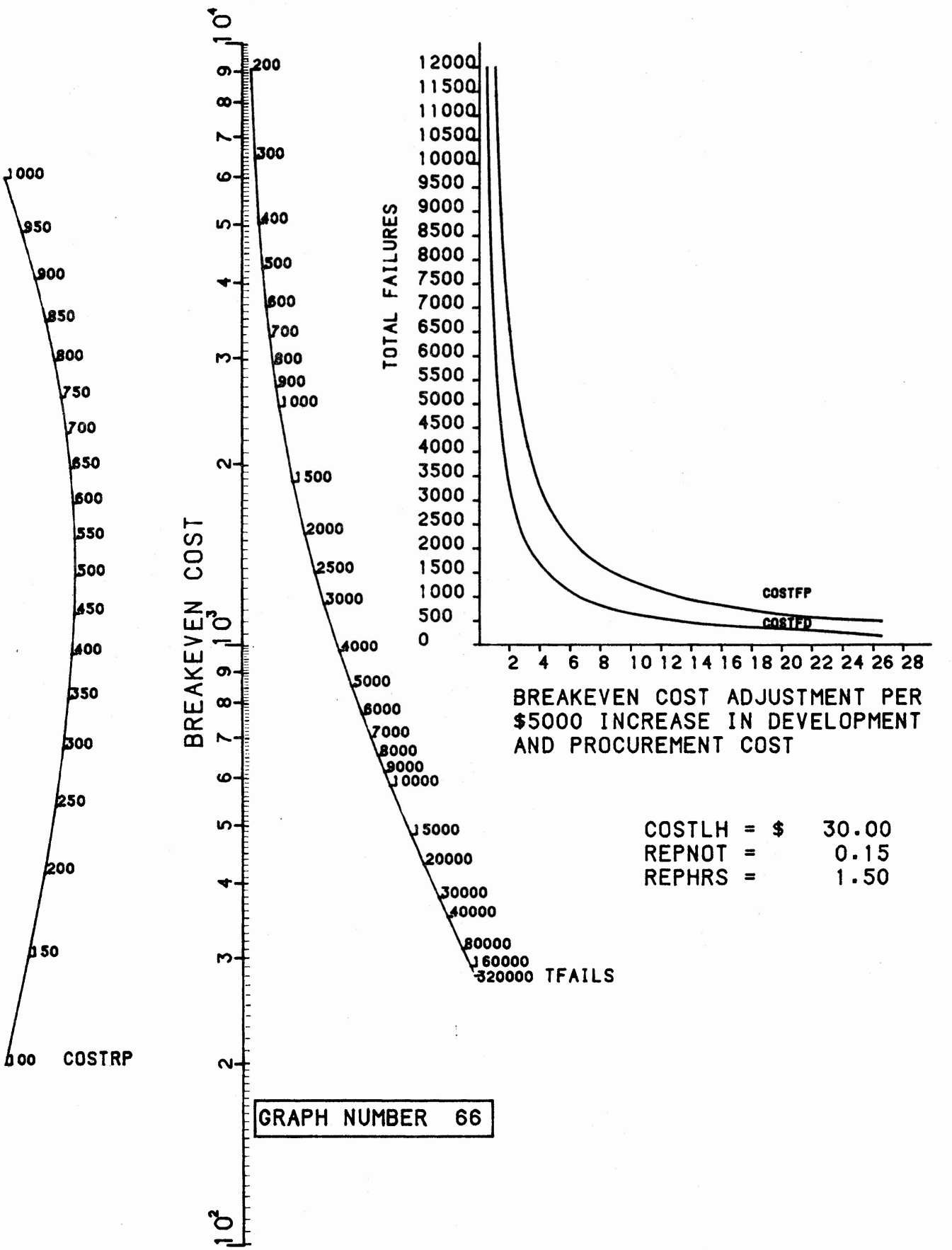
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.15
REPHRS = 1.25
GRAPH NUMBER 65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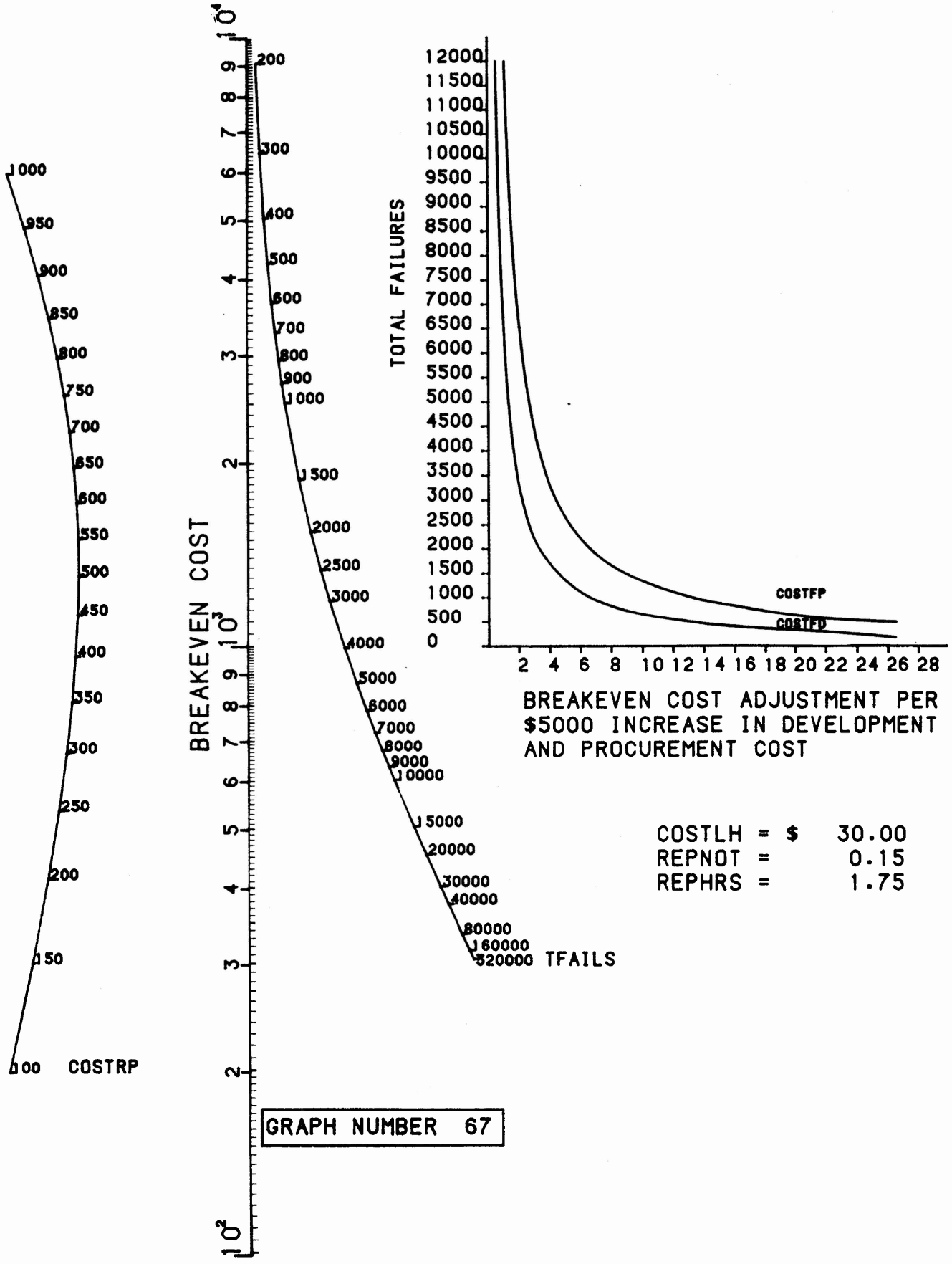
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.15
REPHRS = 1.50
GRAPH NUMBER 66


1000
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100 COSTRP
BREAKEVEN COST
10^4
10^3
10^2
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TOTAL FAILURES
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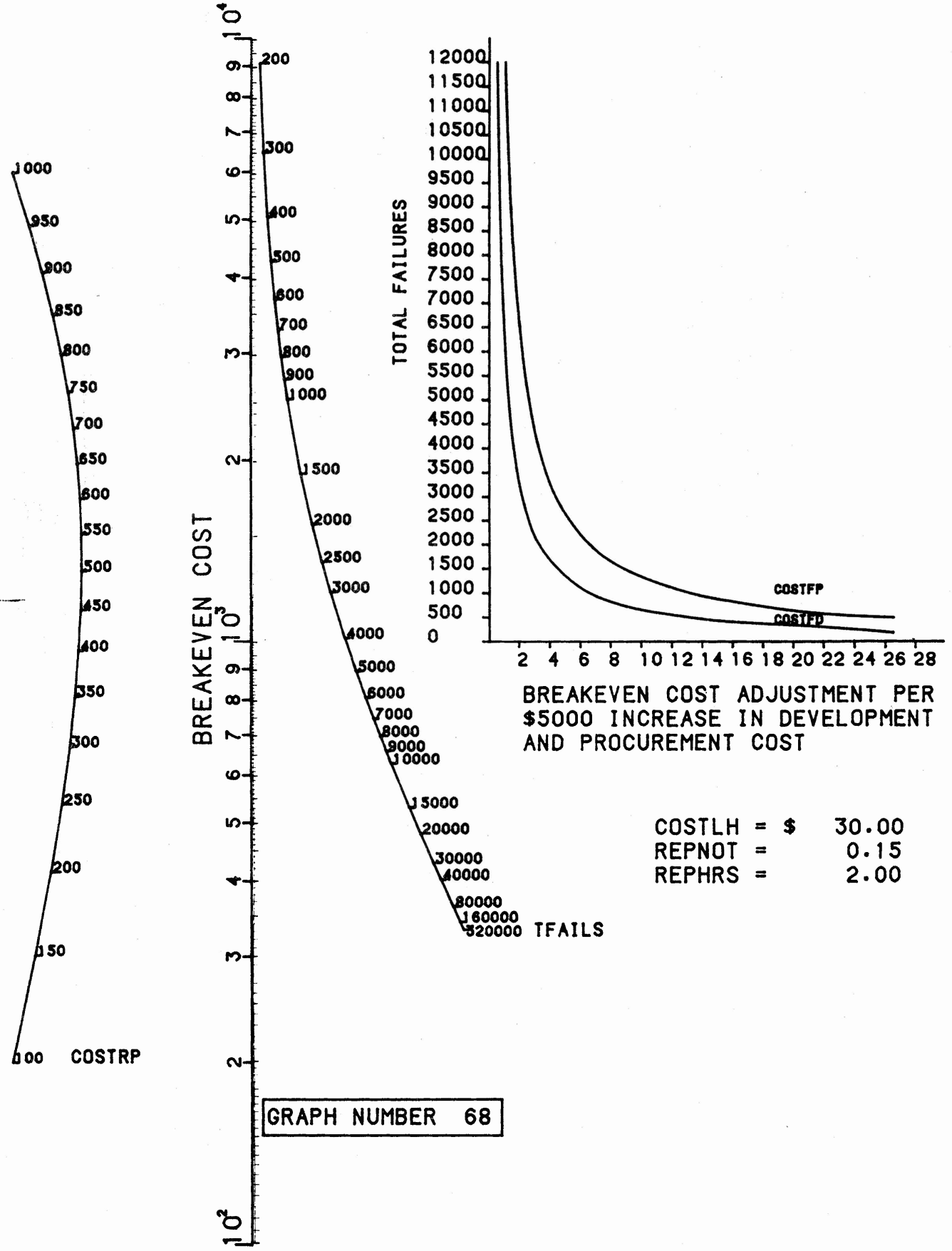
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.15
REPHRS = 1.75
GRAPH NUMBER 67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COSTRP
BREAKEVEN COST
10^4
10^3
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TFAILS
TOTAL FAILURES
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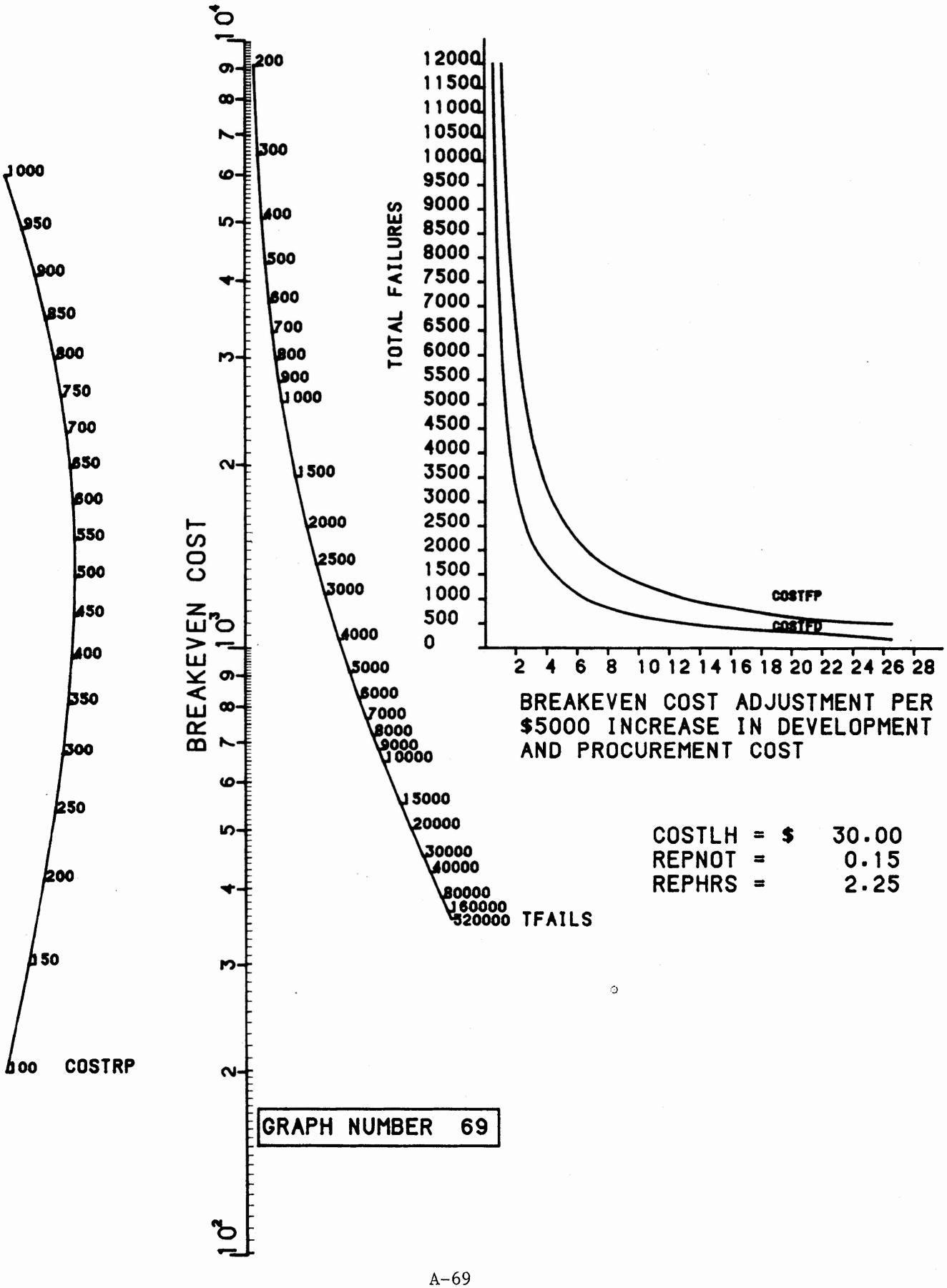
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.15
REPHRS = 2.00
GRAPH NUMBER 68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BREAKEVEN COST
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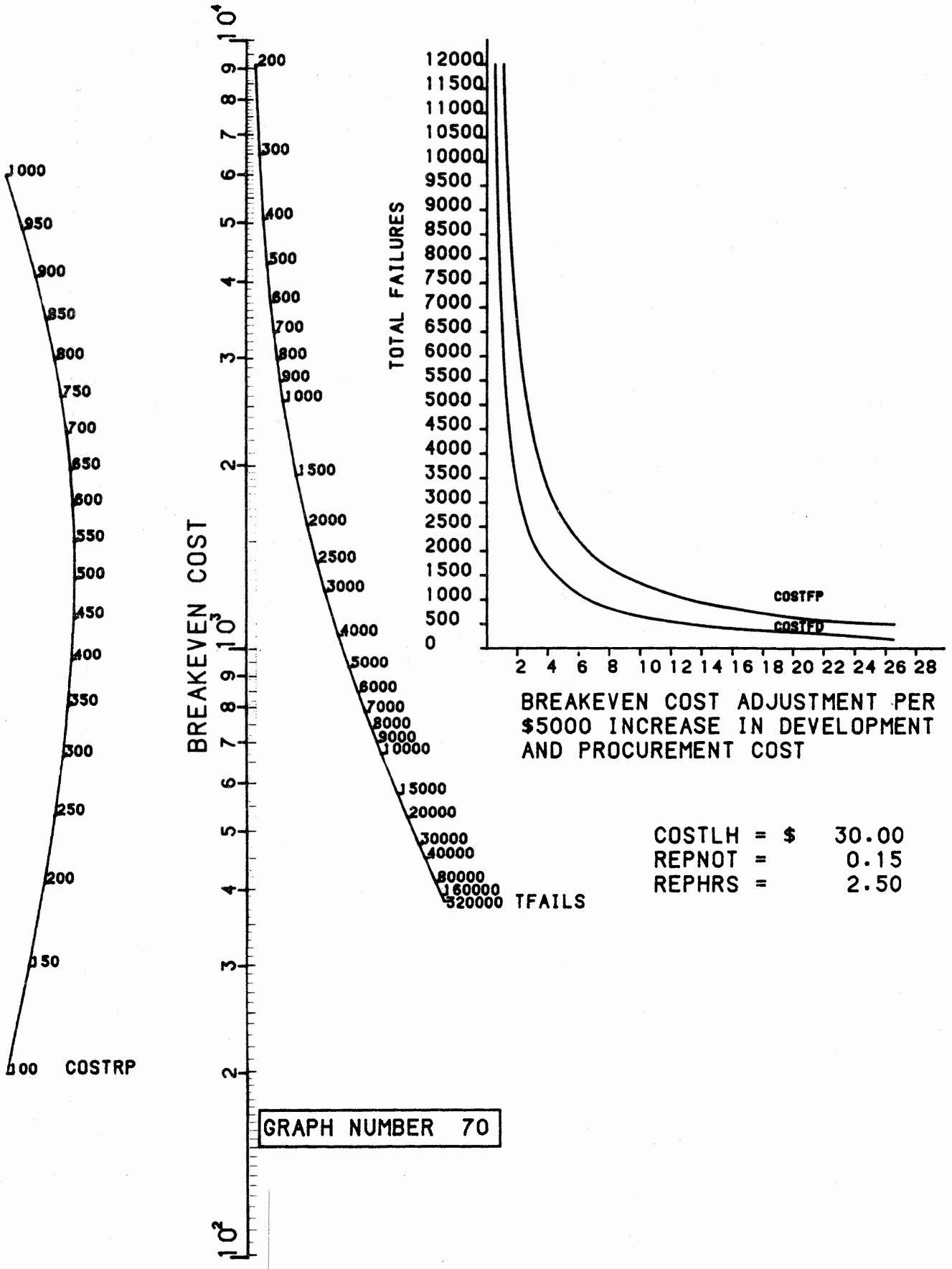
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.15
REPHRS = 2.25
GRAPH NUMBER 69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BREAKEVEN COST
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TOTAL FAILURES
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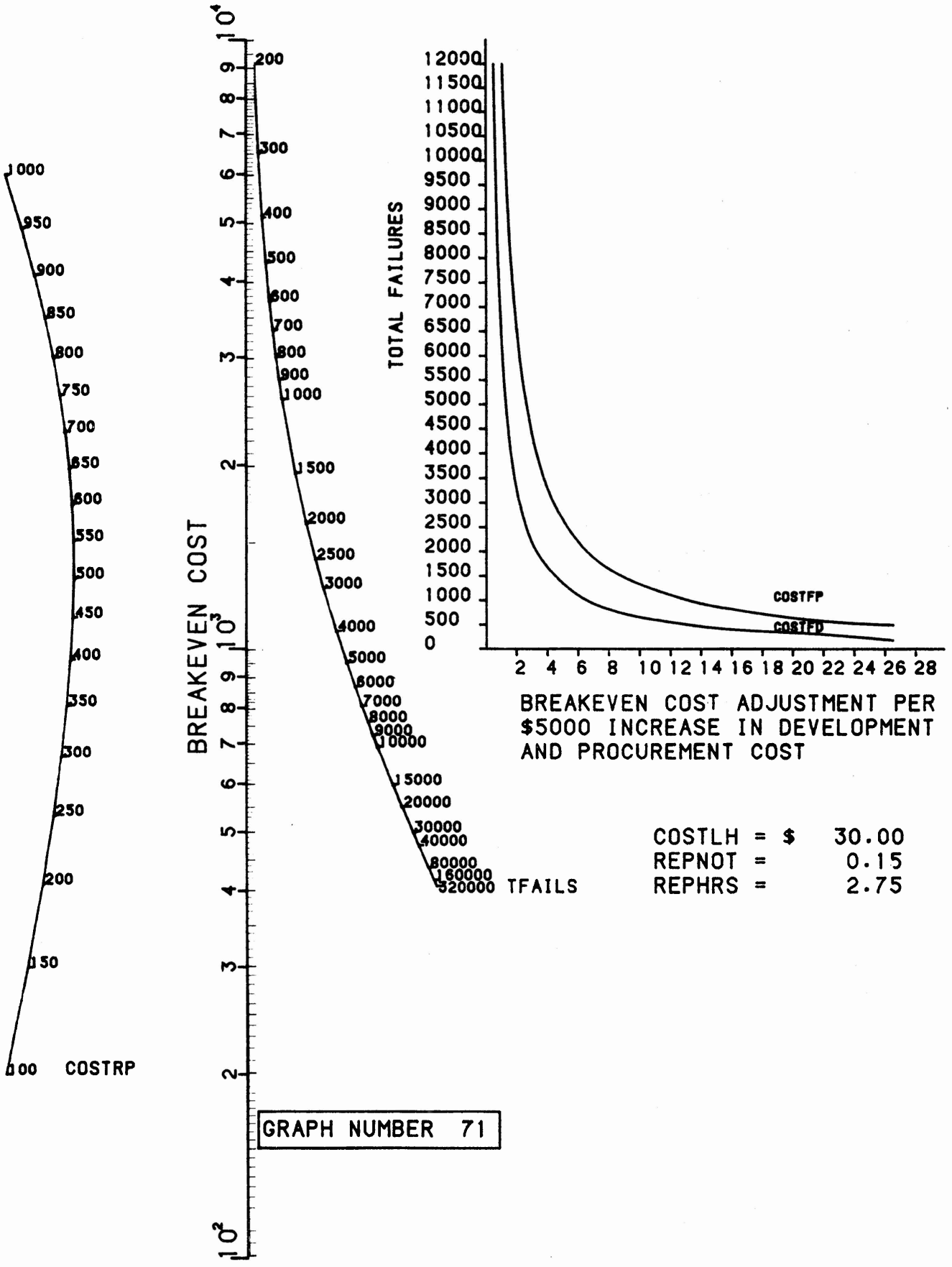
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.15
REPHRS = 2.50
GRAPH NUMBER 70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TFAILS
TOTAL FAILURES
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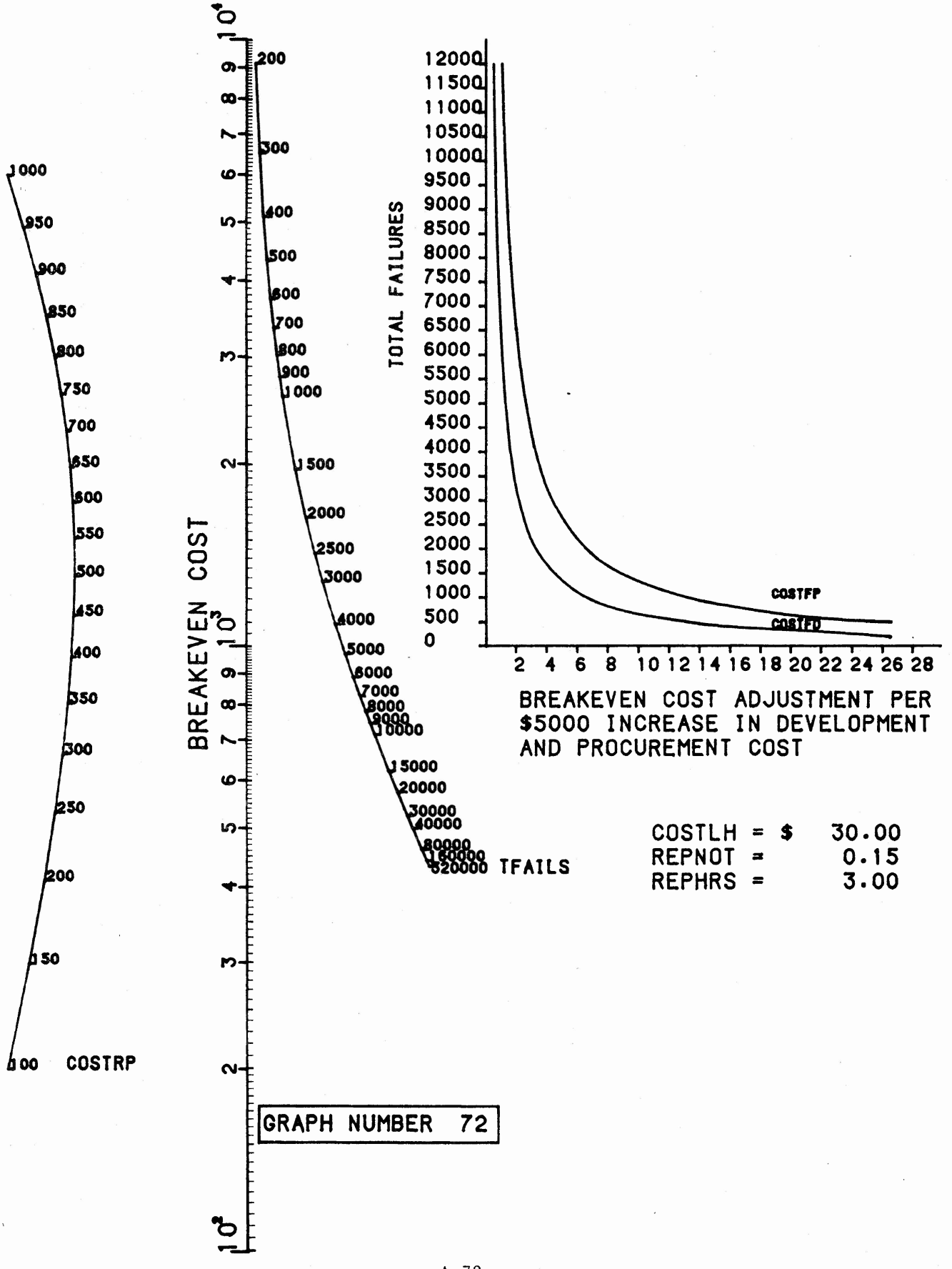
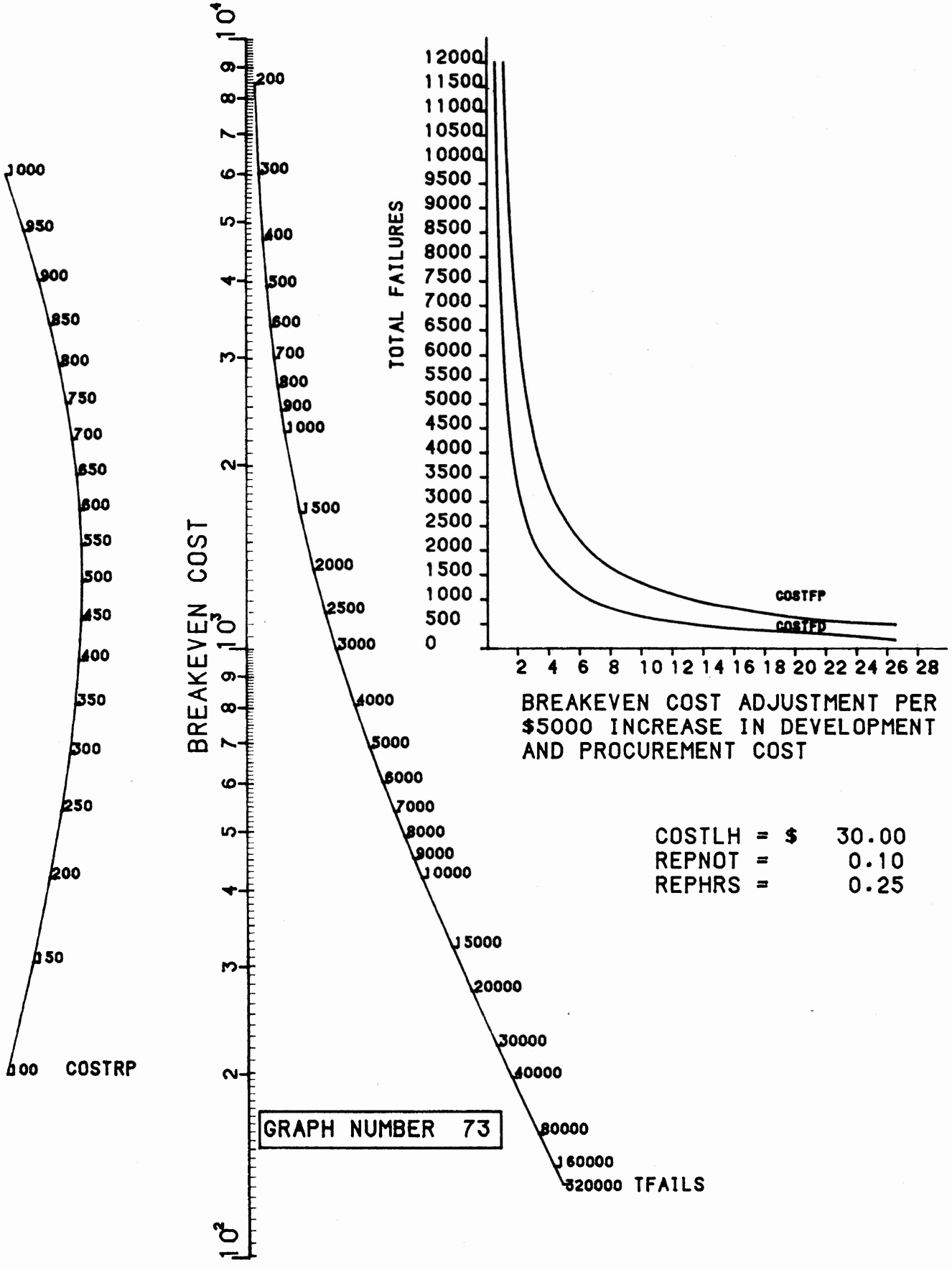
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.15
REPHRS = 2.75
GRAPH NUMBER 71


BREAKEVEN COST
TOTAL FAILURES
COSTRP
TFAILS
COSTFP
COSTFD
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.15
REPHRS = 3.00
GRAPH NUMBER 72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COSTRP
BREAKEVEN COST
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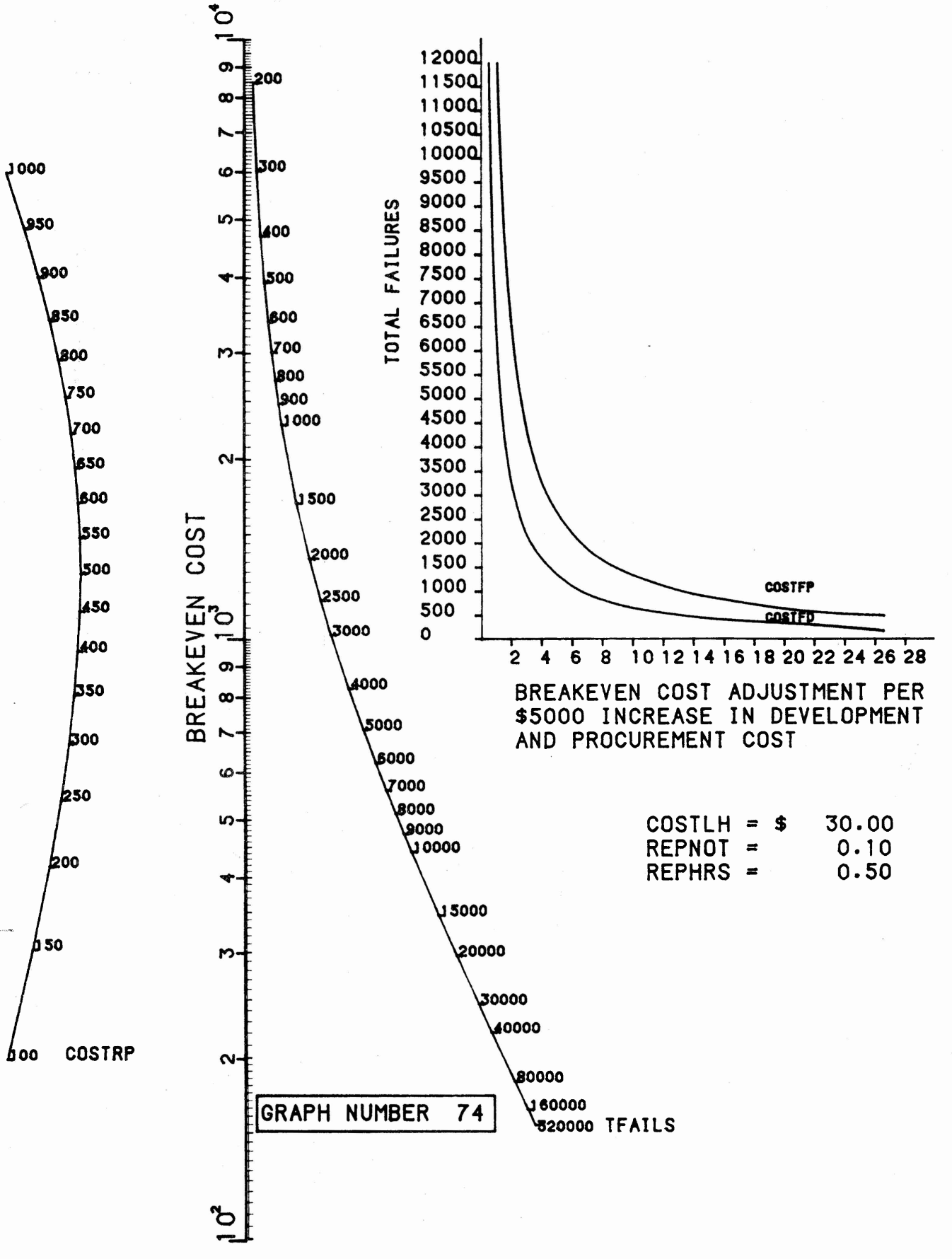
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.10
REPHRS = 0.25
GRAPH NUMBER 73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COSTRP
BREAKEVEN COST
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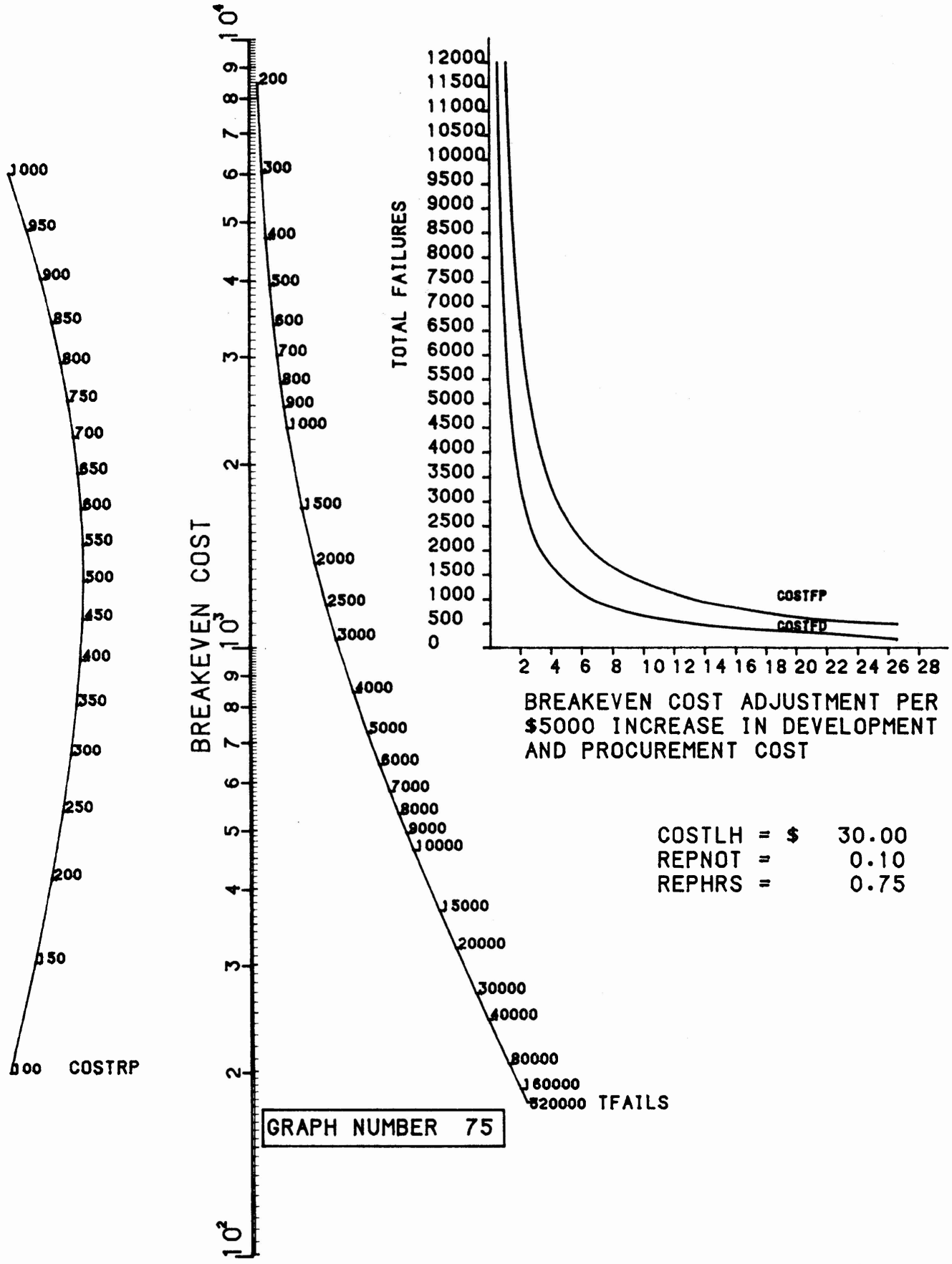
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.10
REPHRS = 0.50
GRAPH NUMBER 74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BREAKEVEN COST
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TOTAL FAILURES
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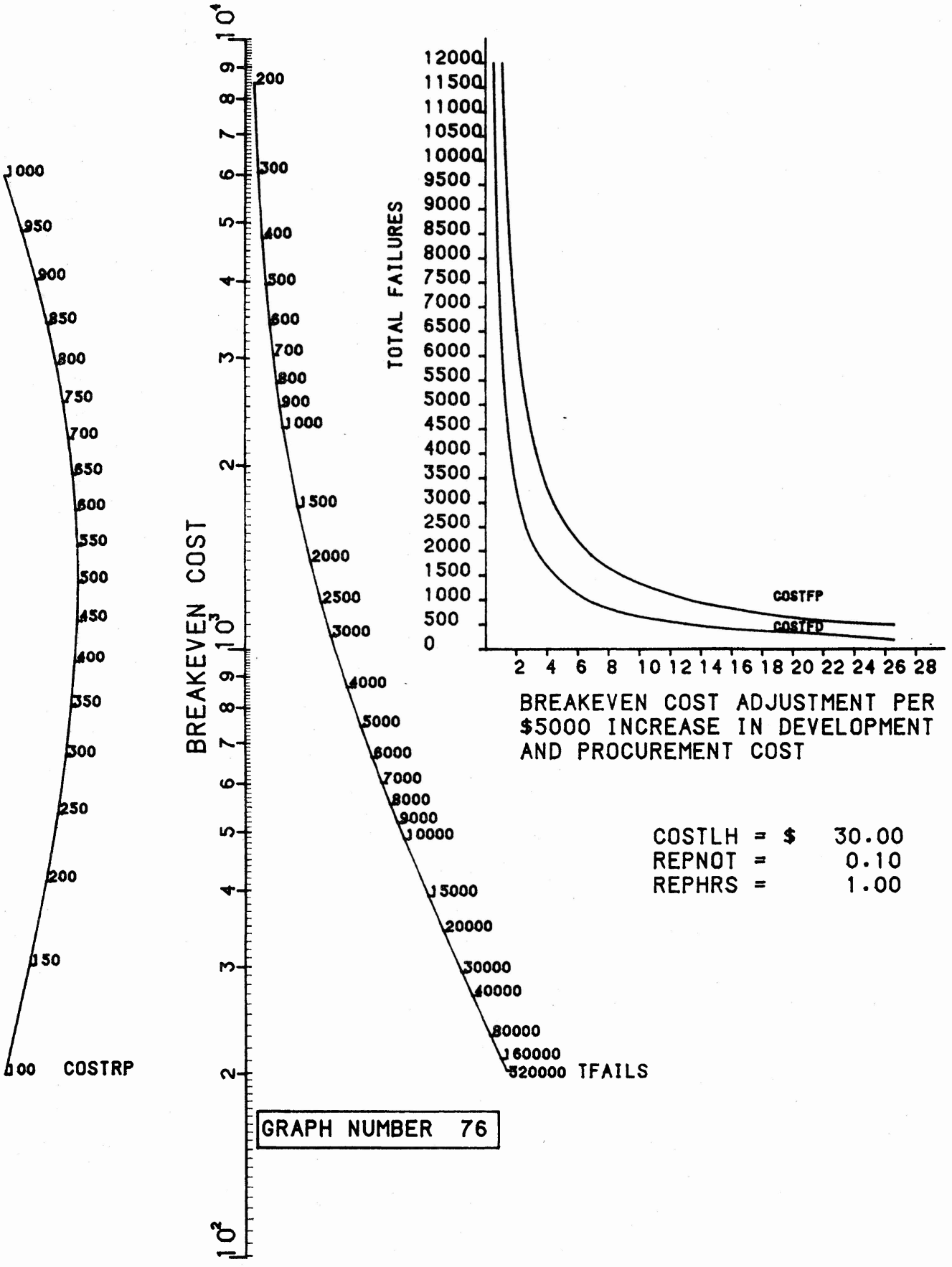
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.10
REPHRS = 0.75
GRAPH NUMBER 75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COSTRP
BREAKEVEN COST
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TFAILS
TOTAL FAILURES
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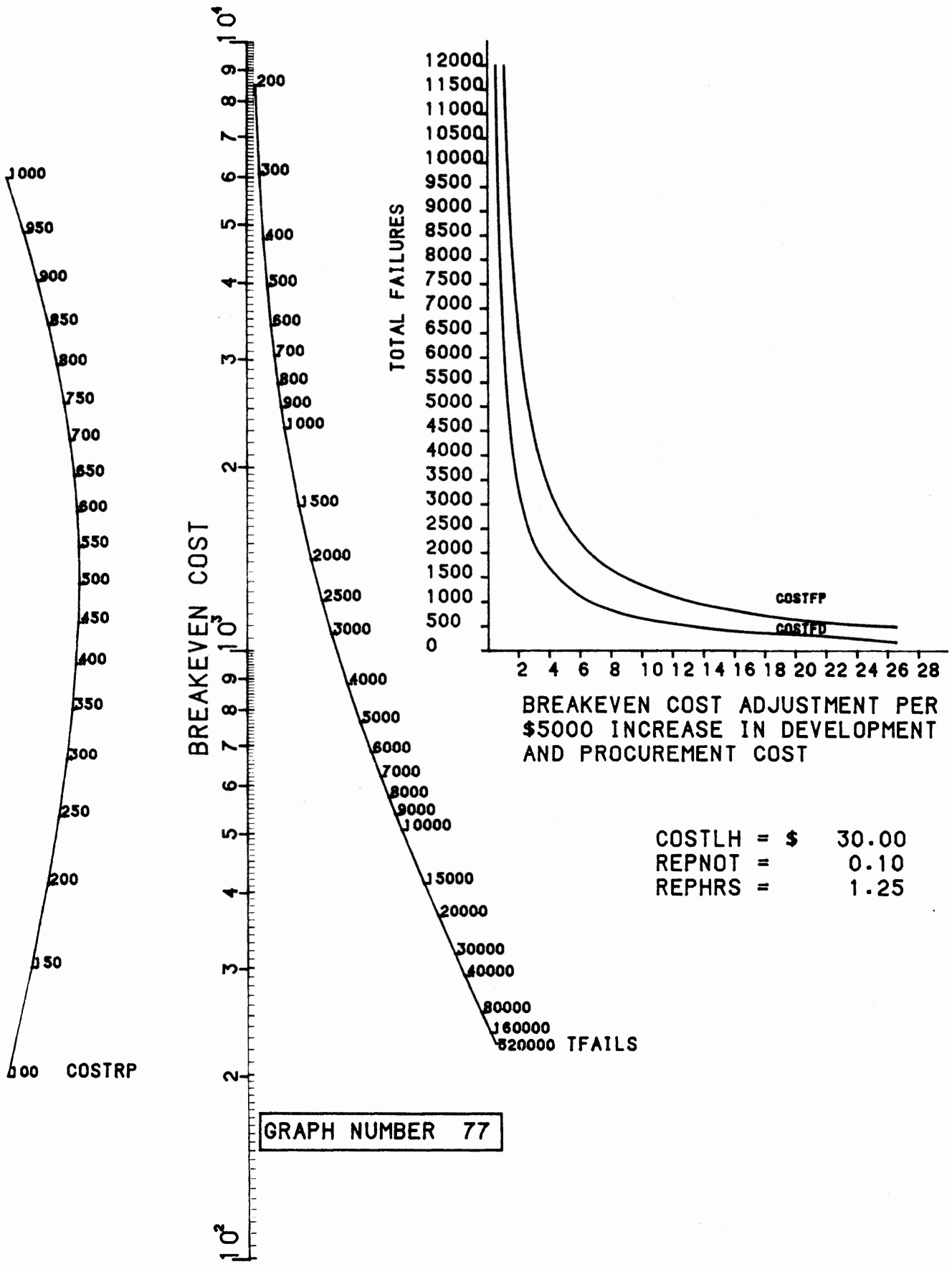
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.10
REPHRS = 1.00
GRAPH NUMBER 76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COSTRP
BREAKEVEN COST
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TFAILS
TOTAL FAILURES
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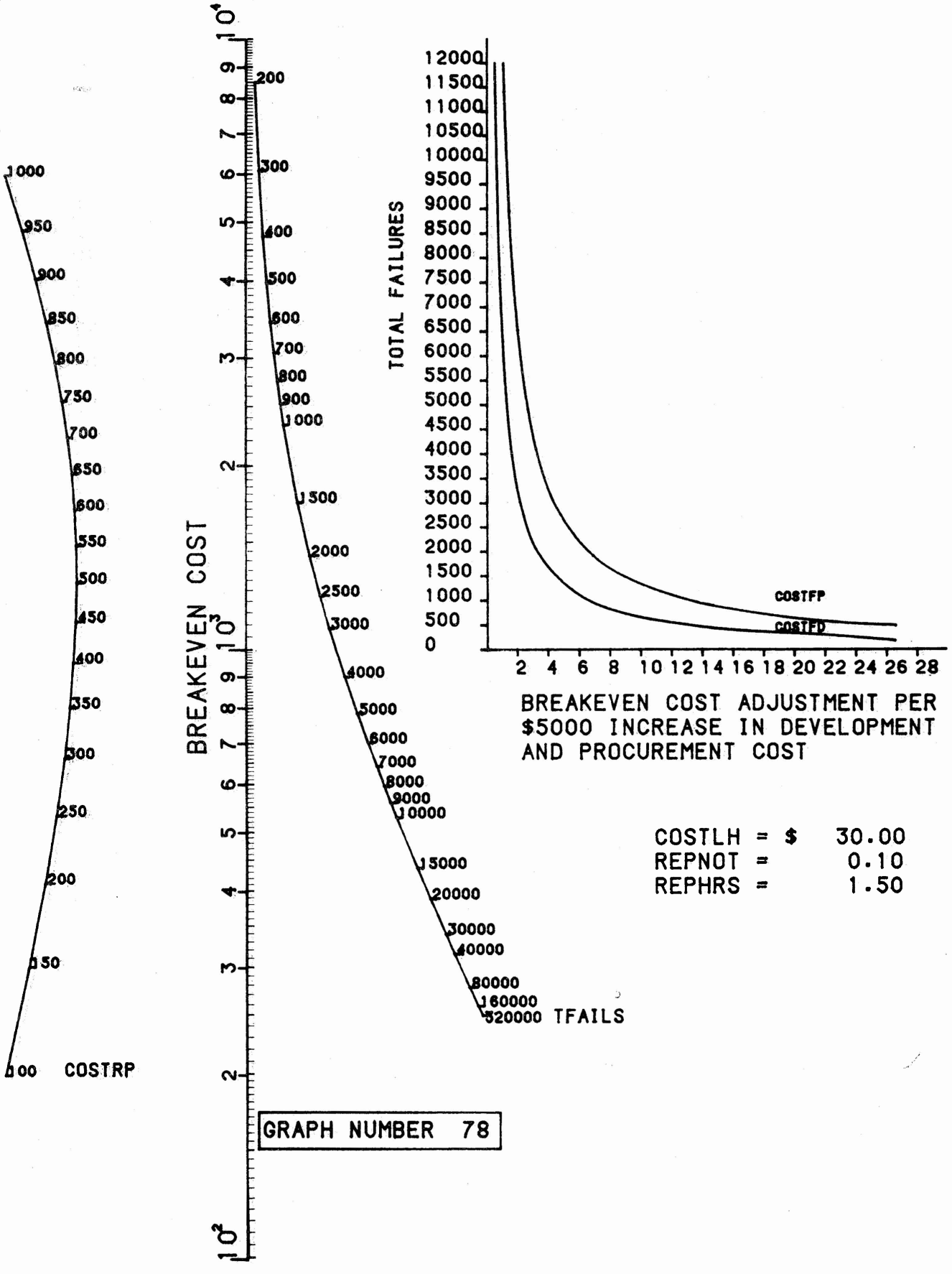
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.10
REPHRS = 1.25
GRAPH NUMBER 77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100 COSTRP
BREAKEVEN COST
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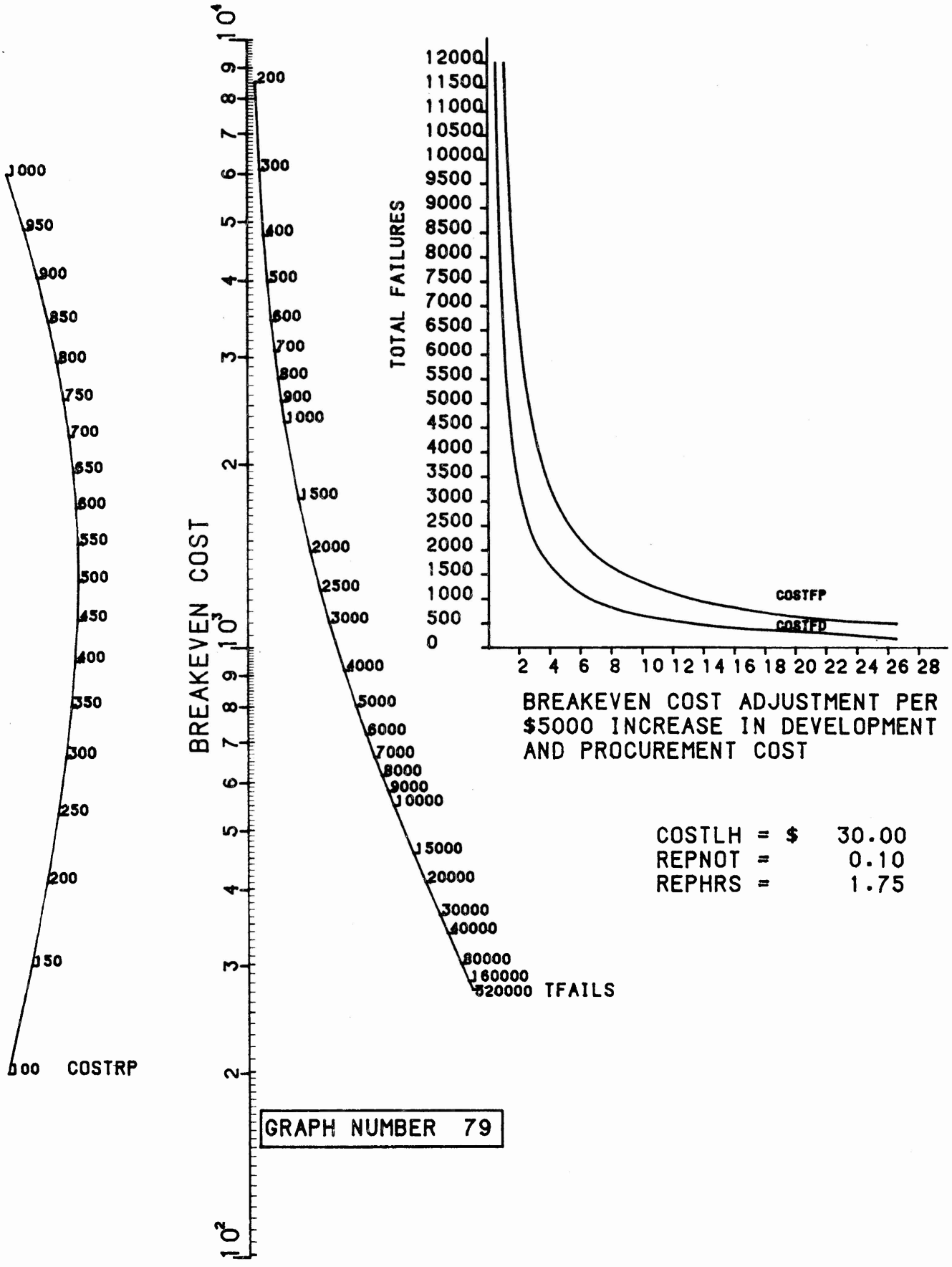
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.10
REPHRS = 1.50
GRAPH NUMBER 78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COSTRP
BREAKEVEN COST
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TFAILS
TOTAL FAILURES
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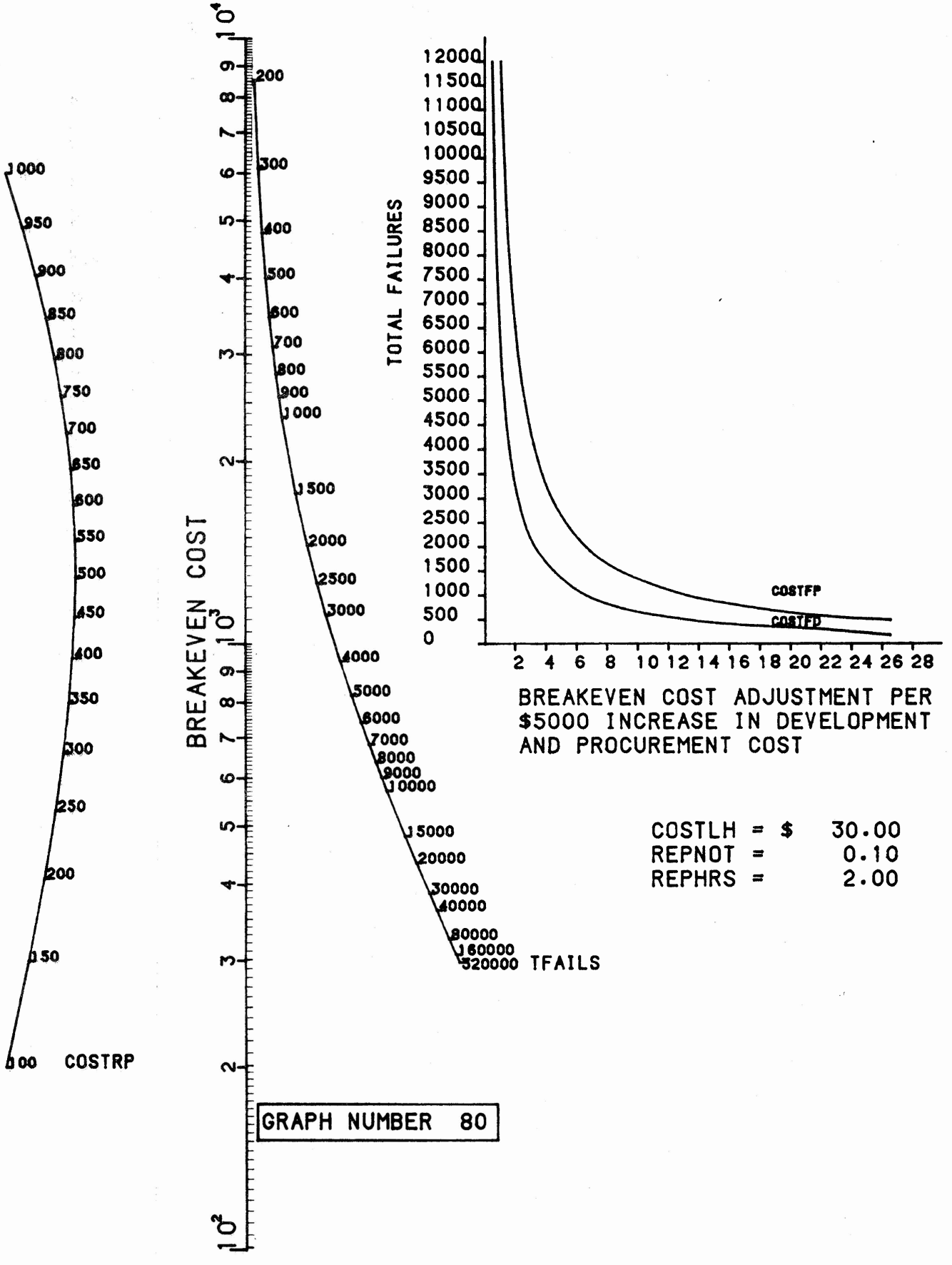
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.10
REPHRS = 1.75
GRAPH NUMBER 79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BREAKEVEN COST
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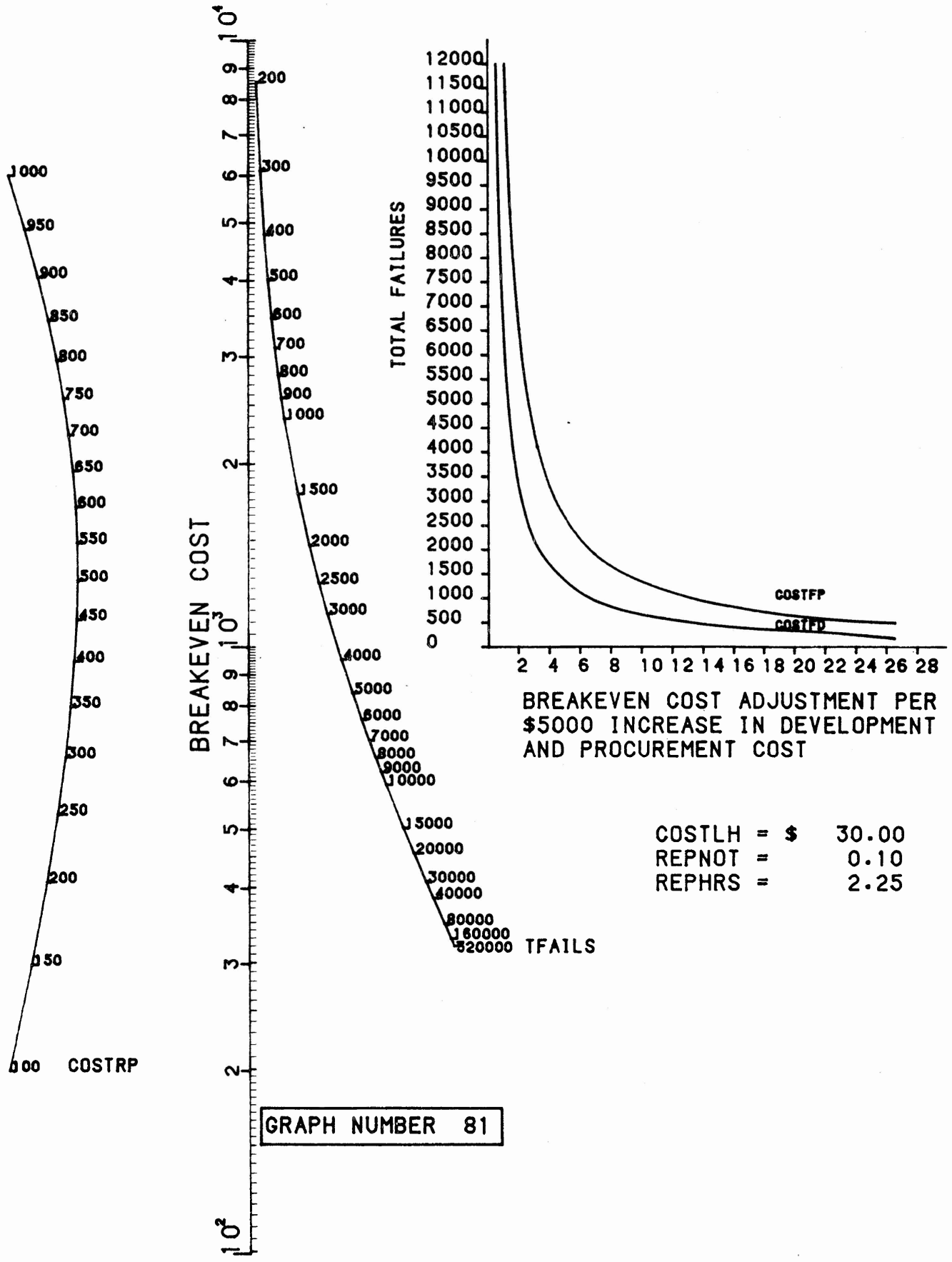
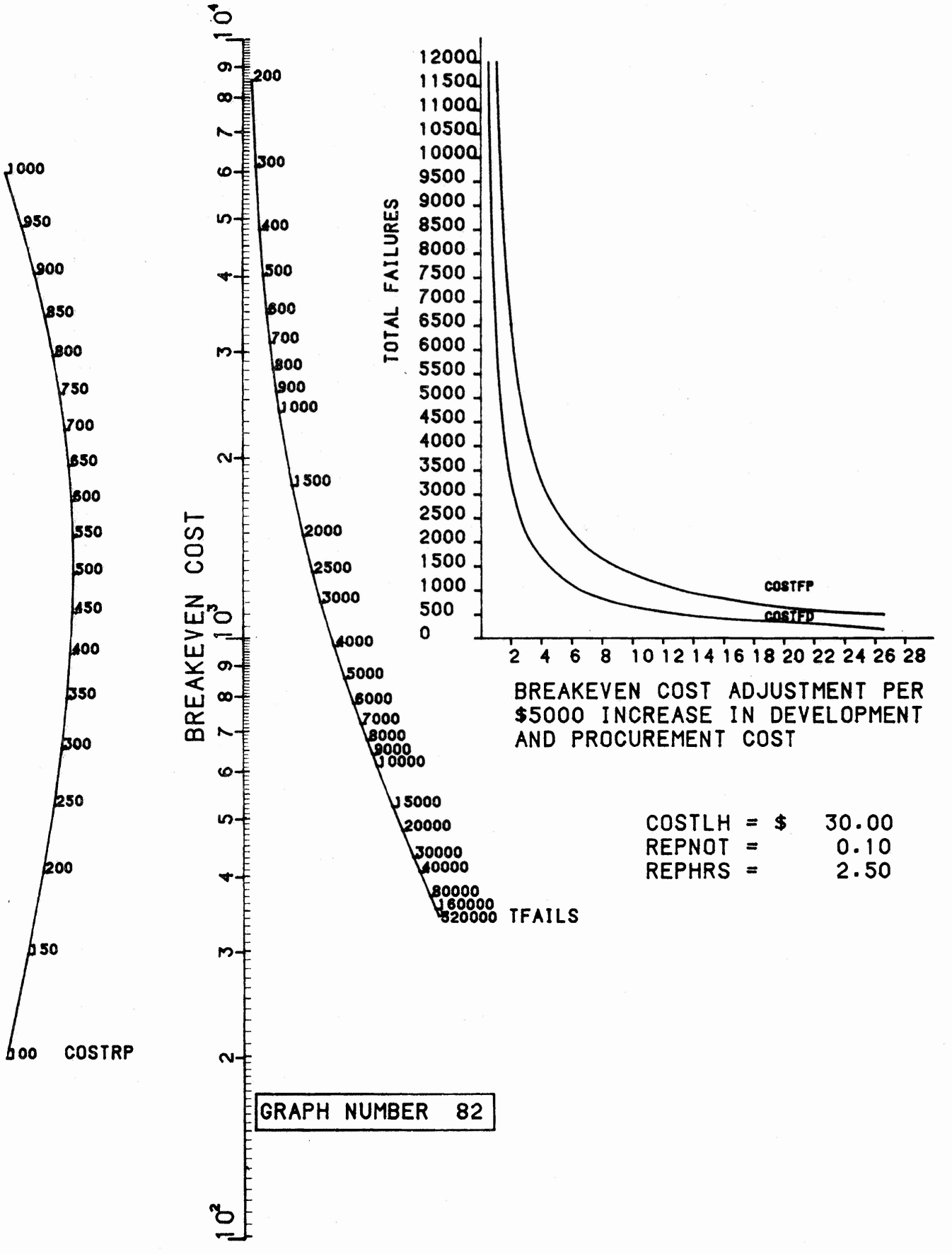
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.10
REPHRS = 2.00
GRAPH NUMBER 80


BREAKEVEN COST
TOTAL FAILURES
COSTRP
TFAILS
COSTFP
COSTFD
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.10
REPHRS = 2.25
GRAPH NUMBER 81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COSTRP
BREAKEVEN COST
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TFAILS
TOTAL FAILURES
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4500
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1500
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500
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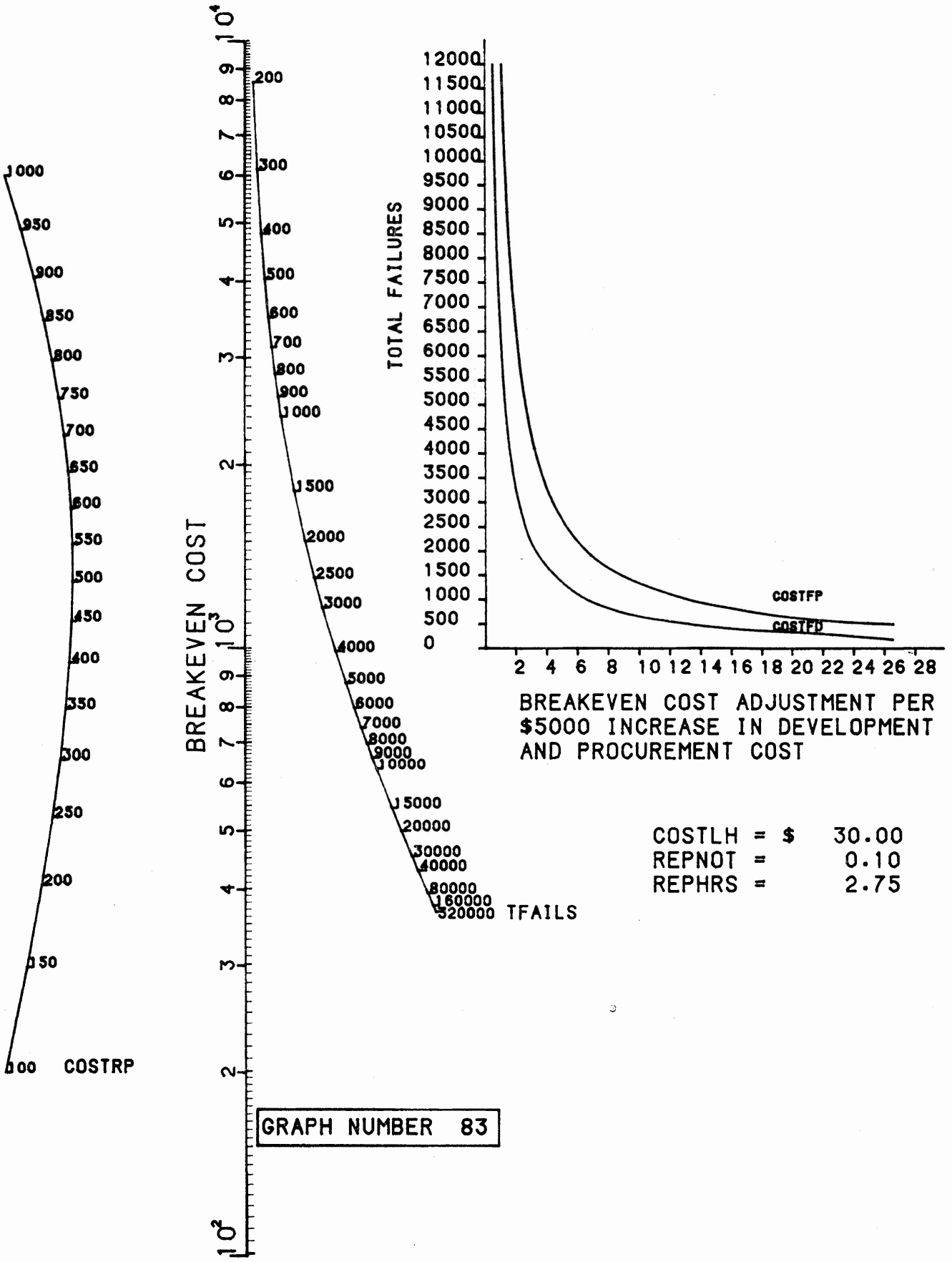
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.10
REPHRS = 2.50
GRAPH NUMBER 82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320000 TFAILS
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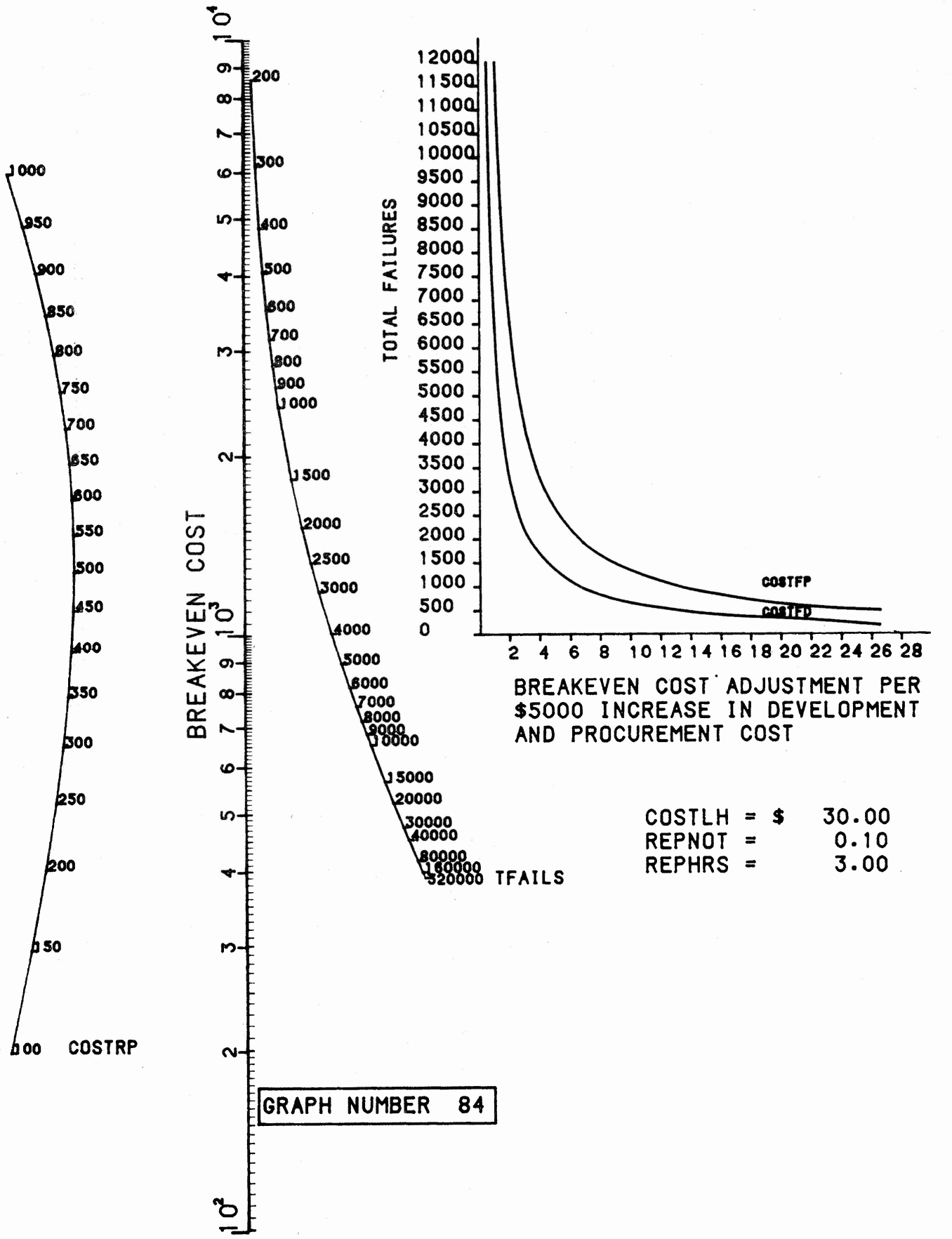
COSTFP
COSTFD
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.10
REPHRS = 2.75
GRAPH NUMBER 83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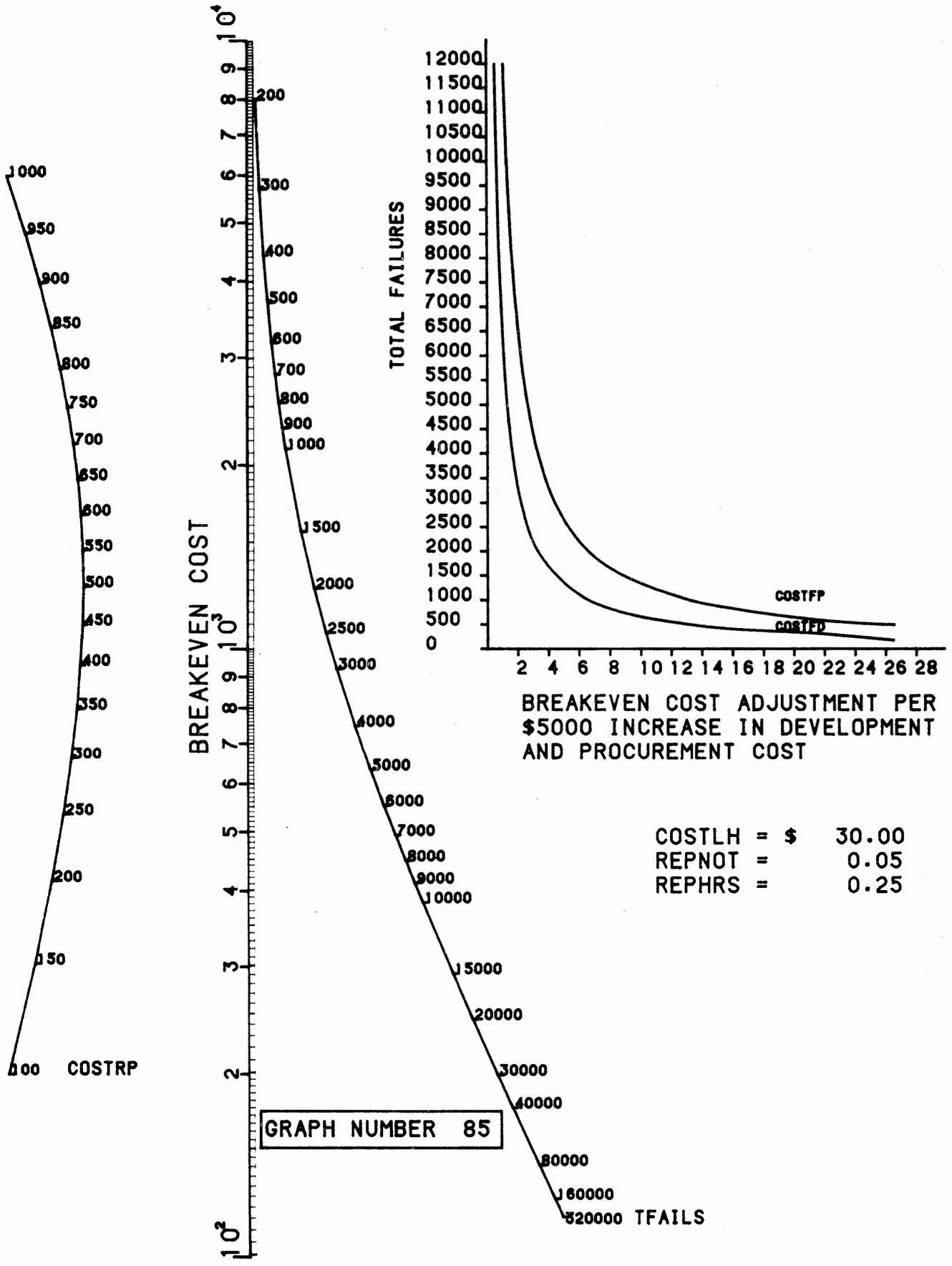
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.10
REPHRS = 3.00
GRAPH NUMBER 84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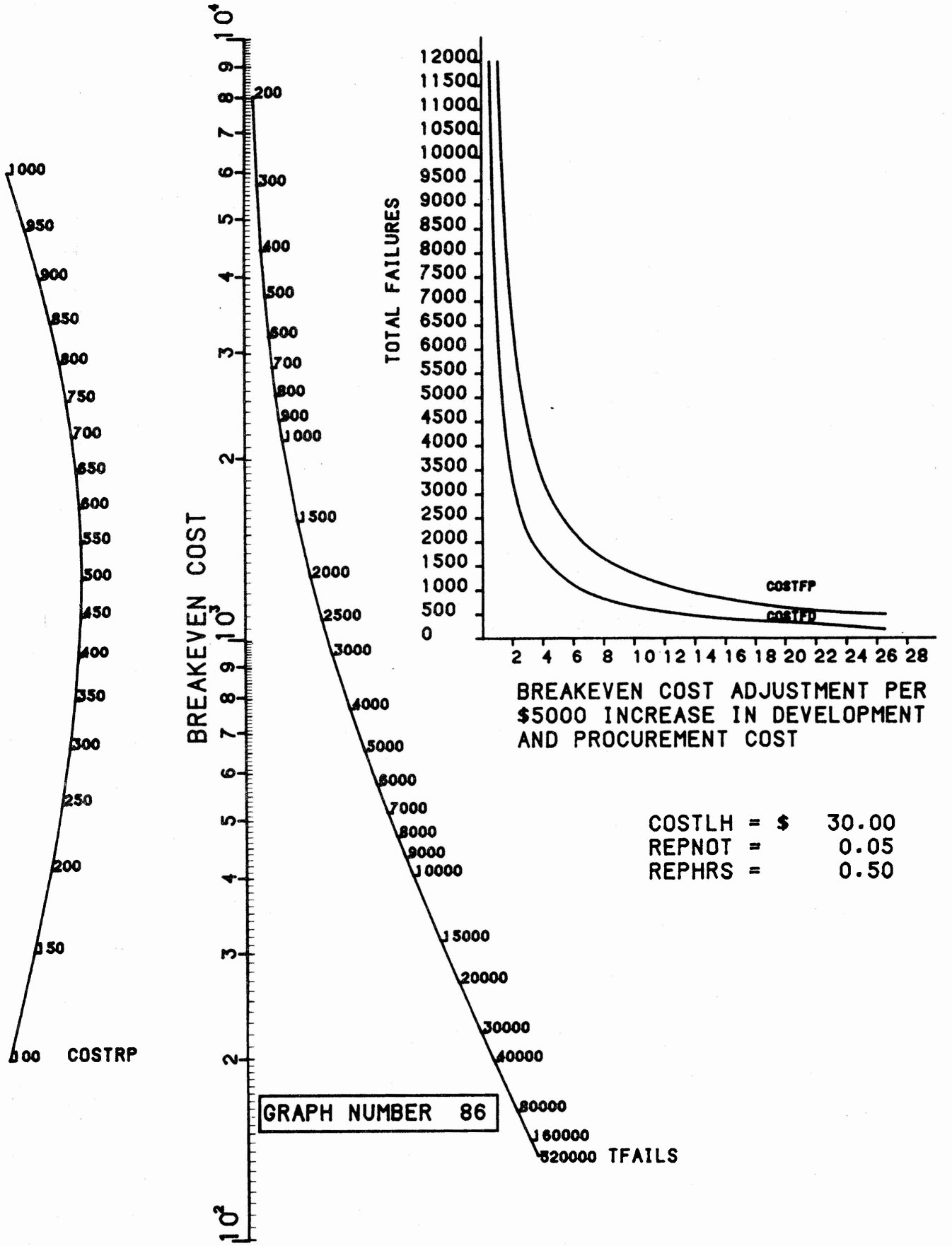
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.05
REPHRS = 0.25
GRAPH NUMBER 85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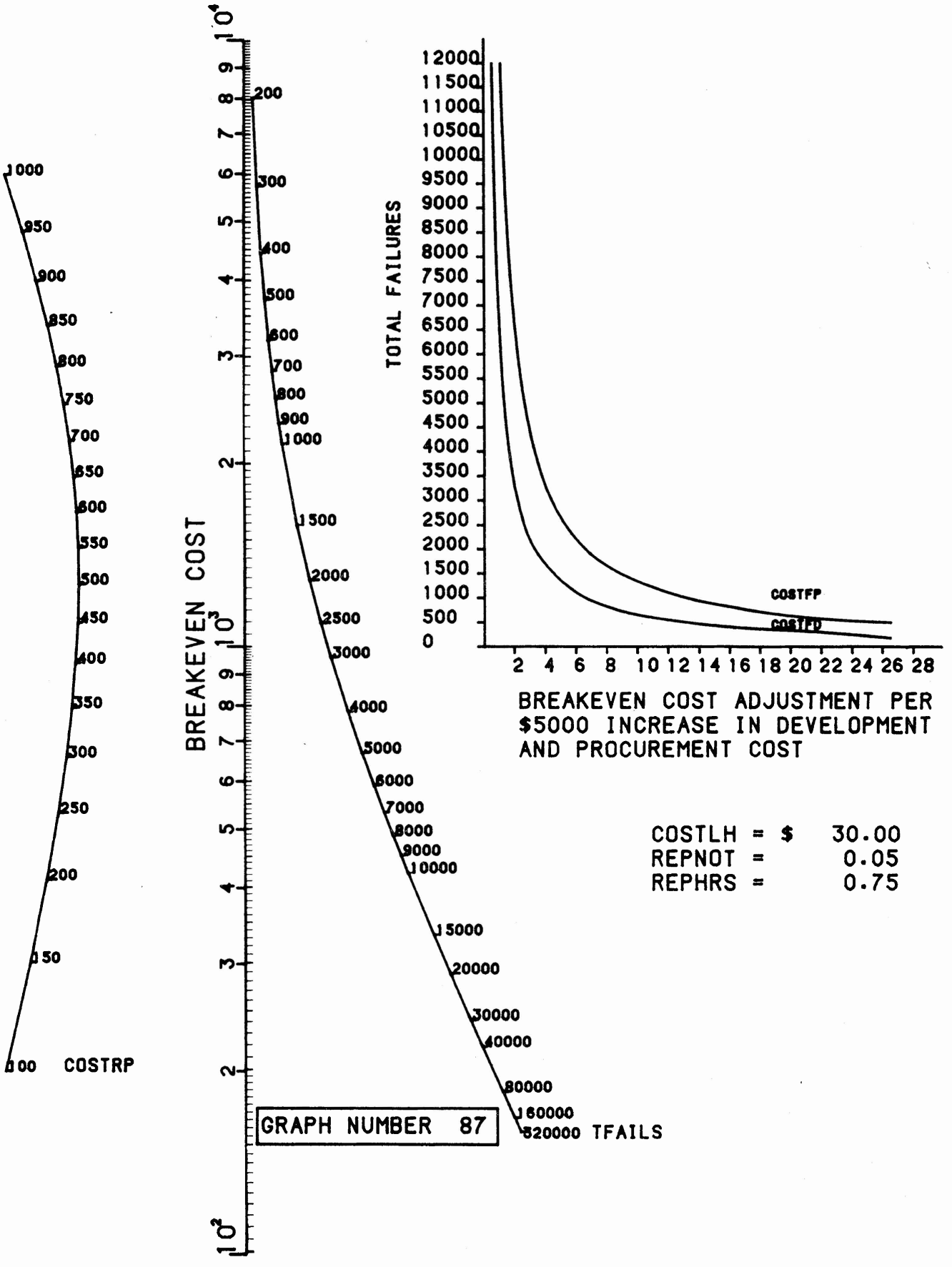
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.05
REPHRS = 0.50
GRAPH NUMBER 86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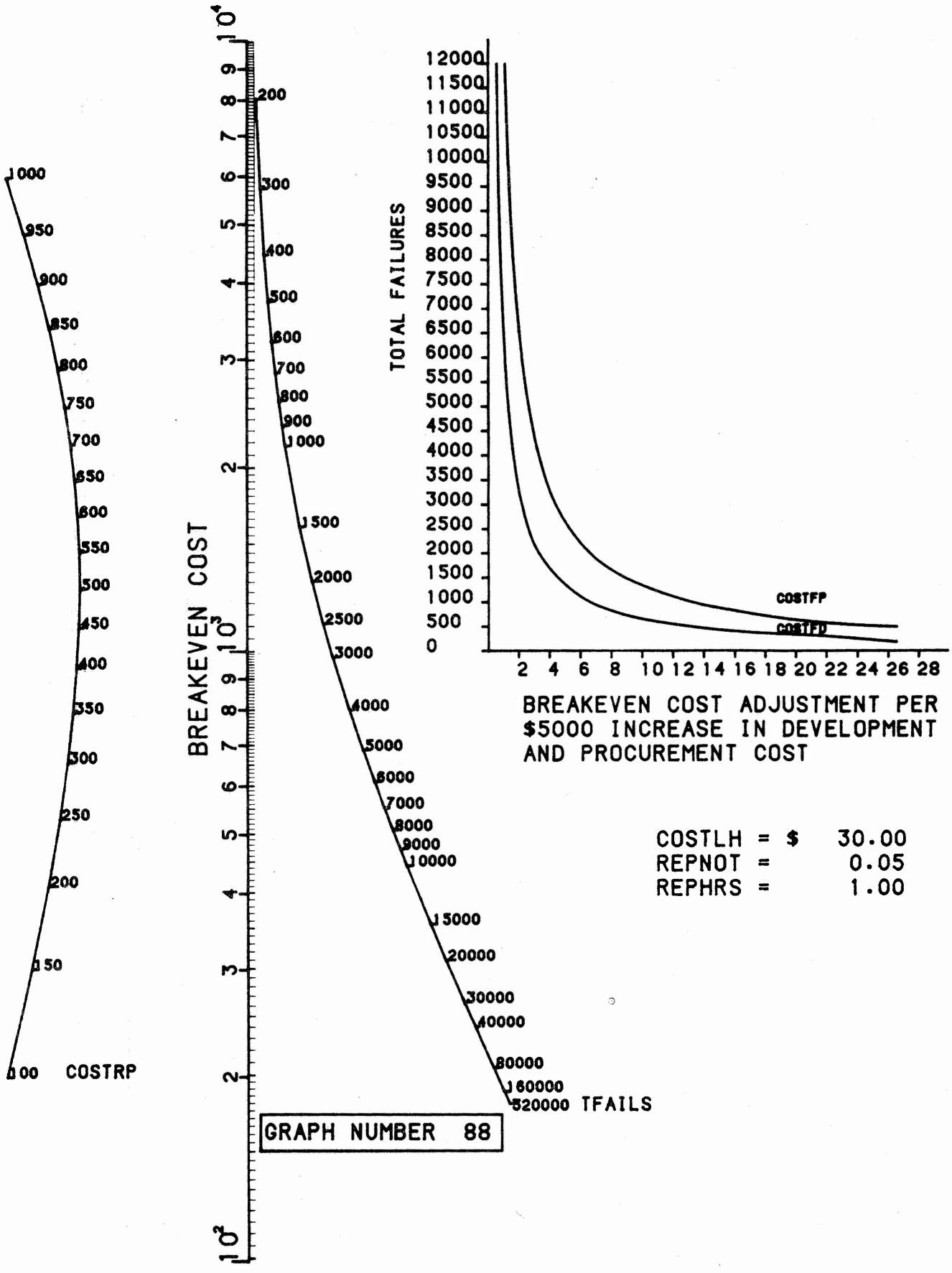
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.05
REPHRS = 0.75
GRAPH NUMBER 87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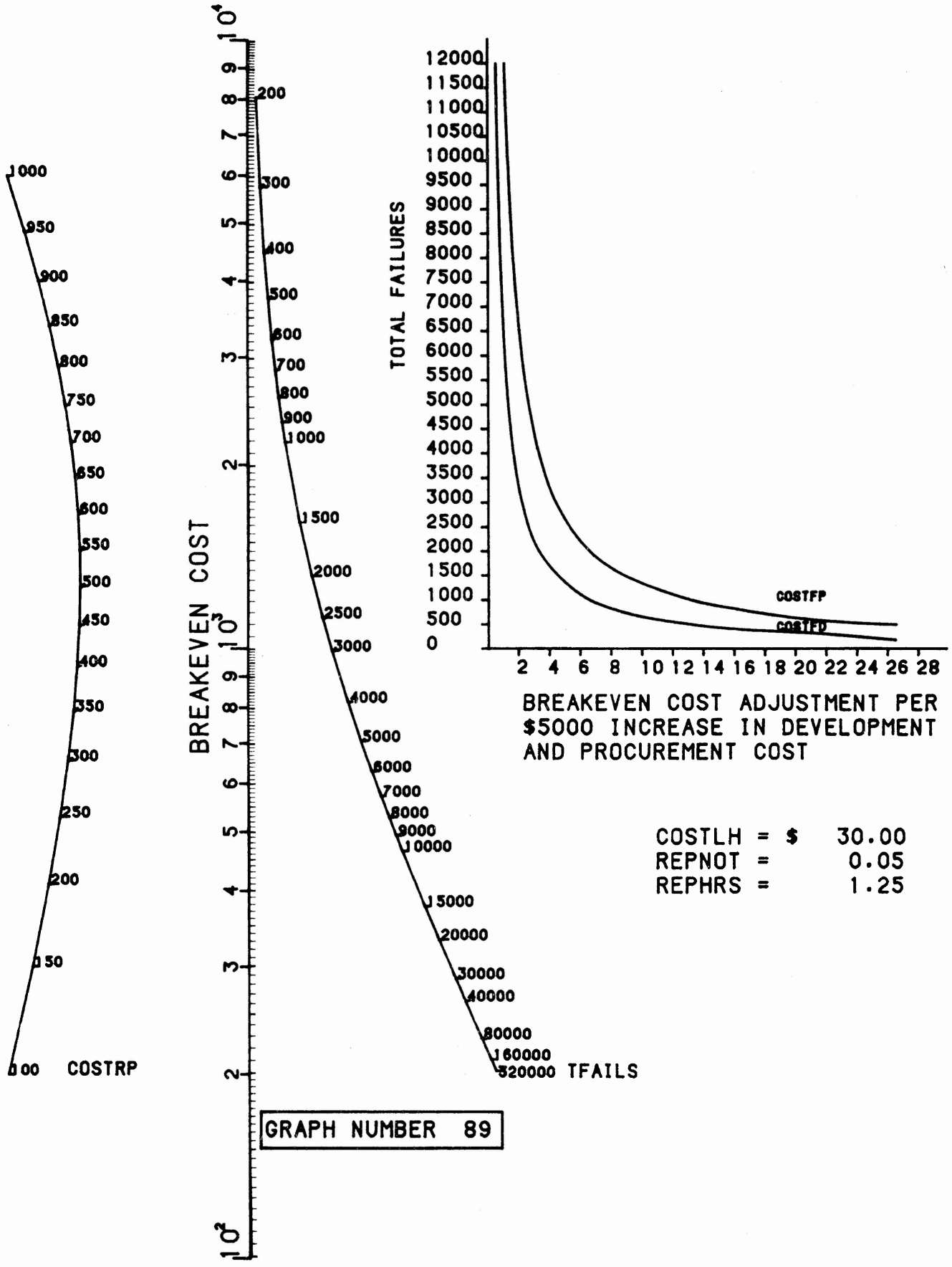
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.05
REPHRS = 1.00
GRAPH NUMBER 88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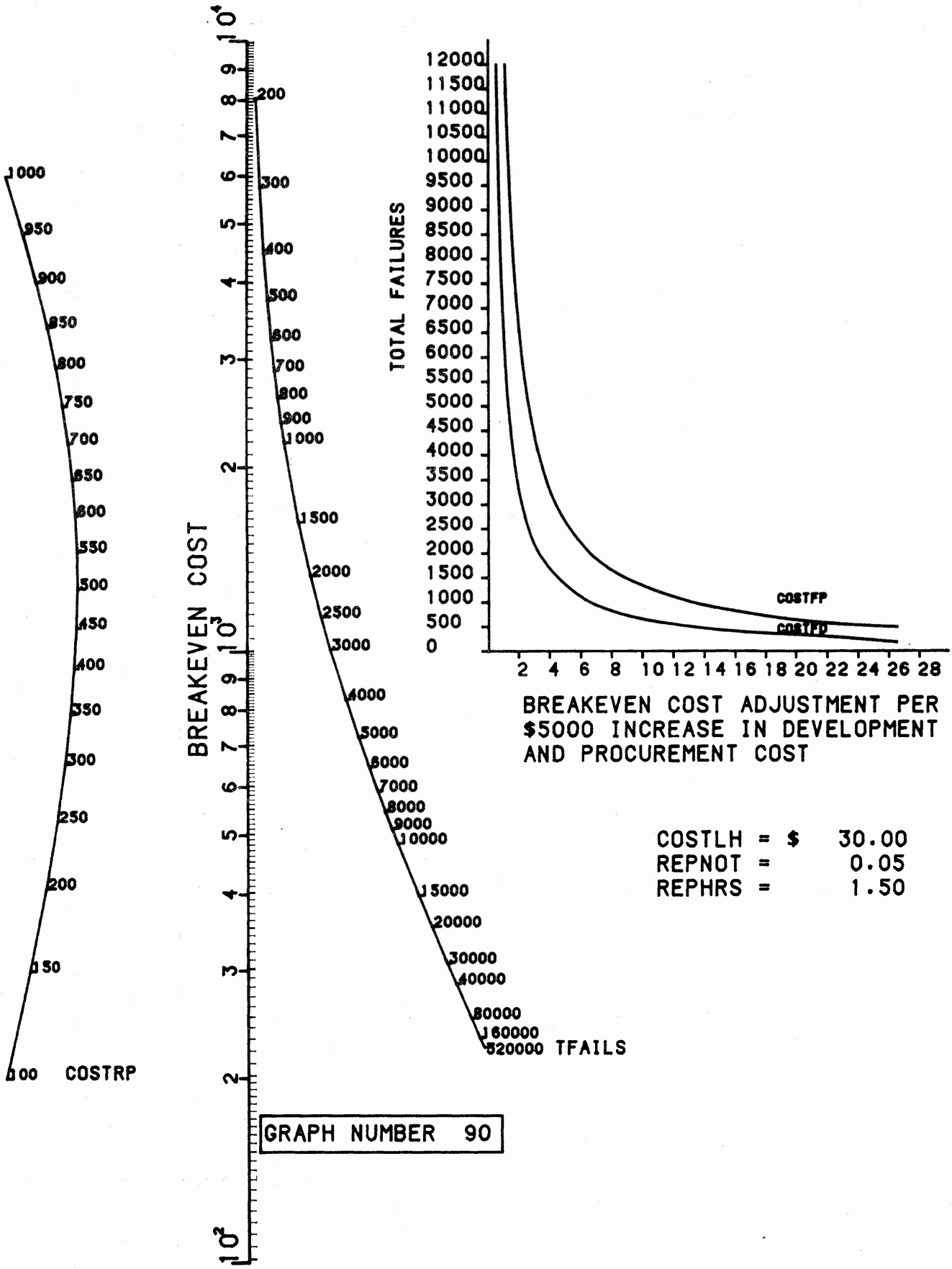
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.05
REPHRS = 1.25
GRAPH NUMBER 89


BREAKEVEN COST
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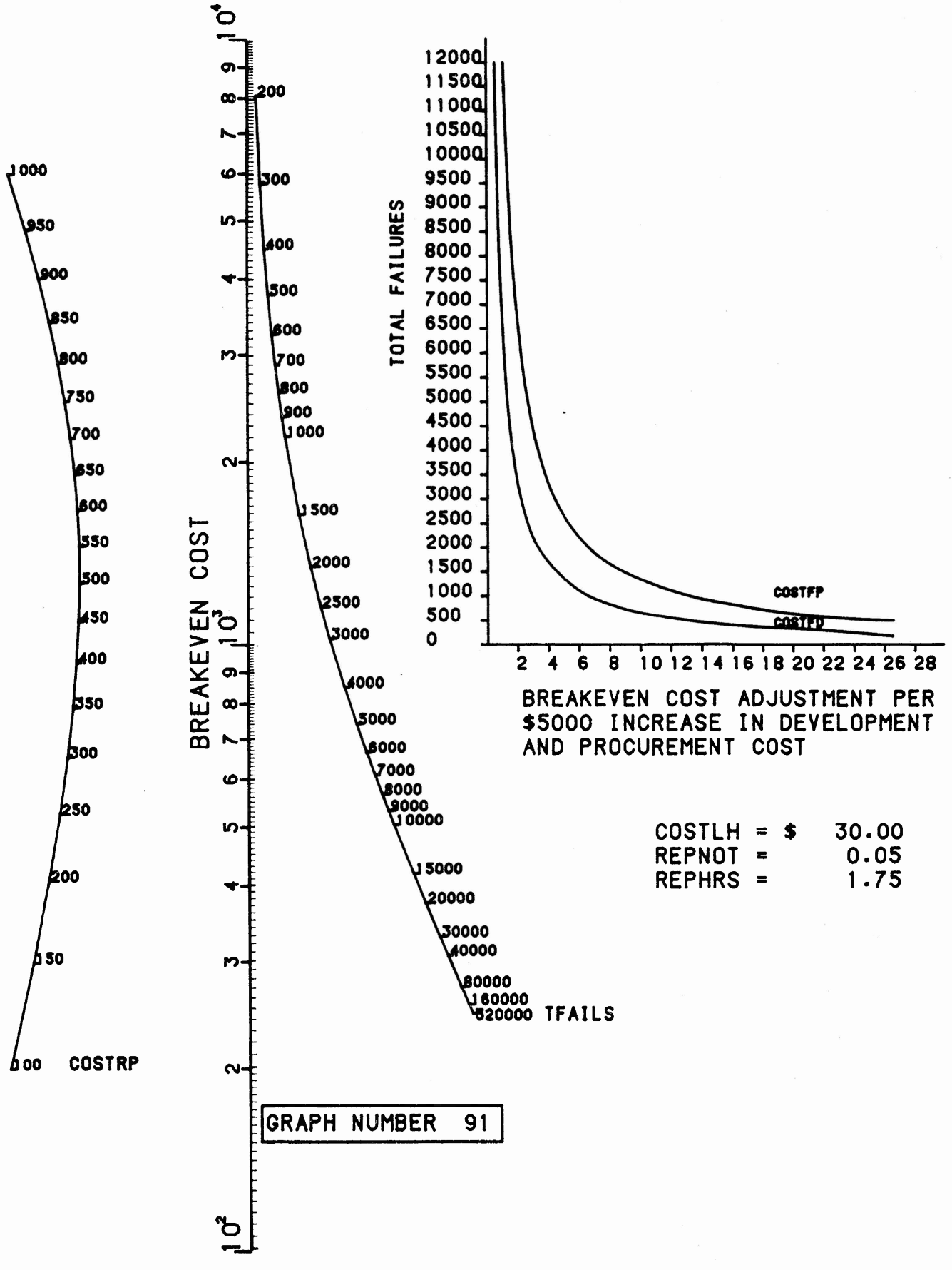
COSTLH = $ 30.00
REPNOT = 0.05
REPHRS = 1.50
GRAPH NUMBER 90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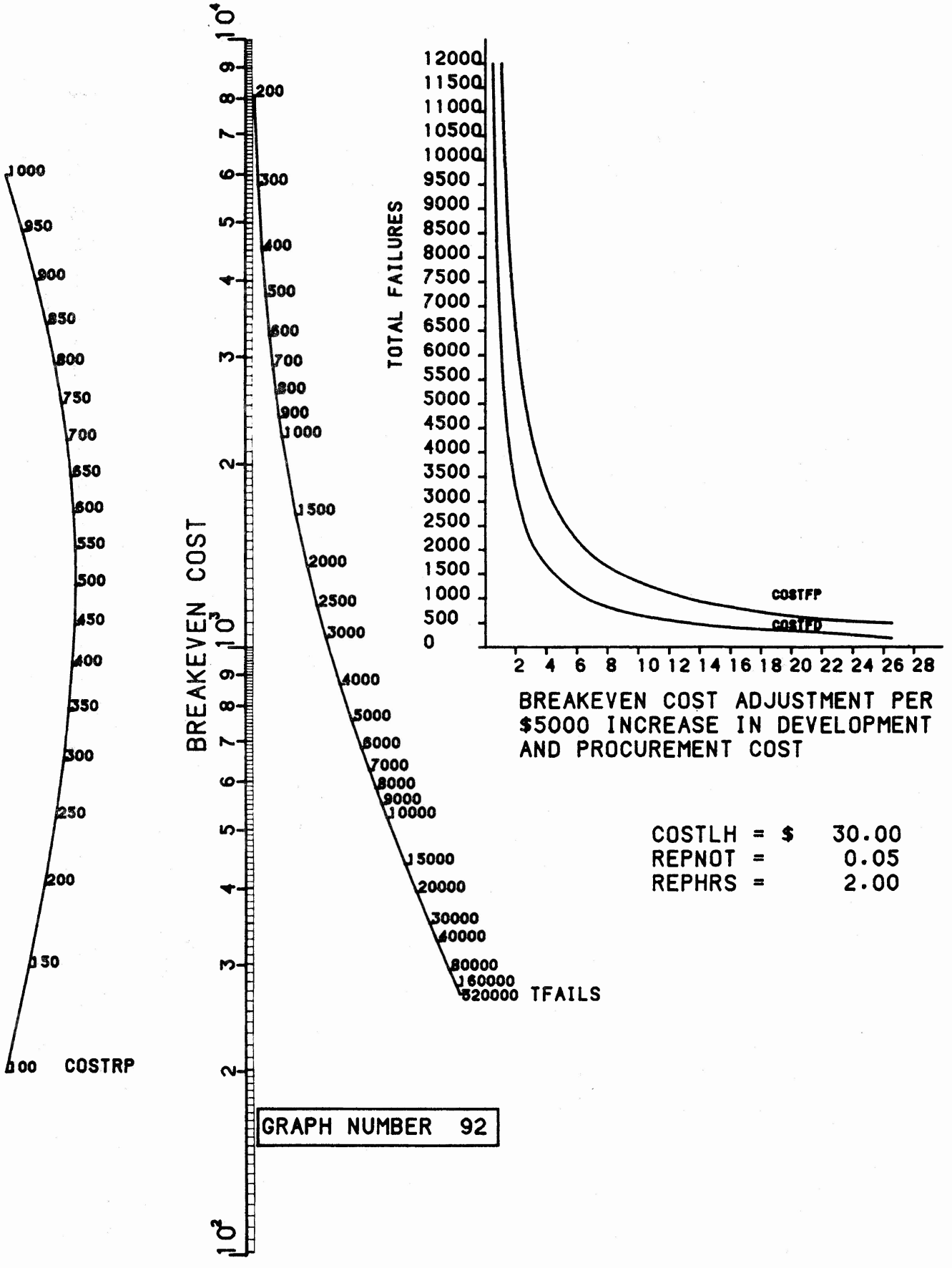
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.05
REPHRS = 1.75
GRAPH NUMBER 91


COSTRP
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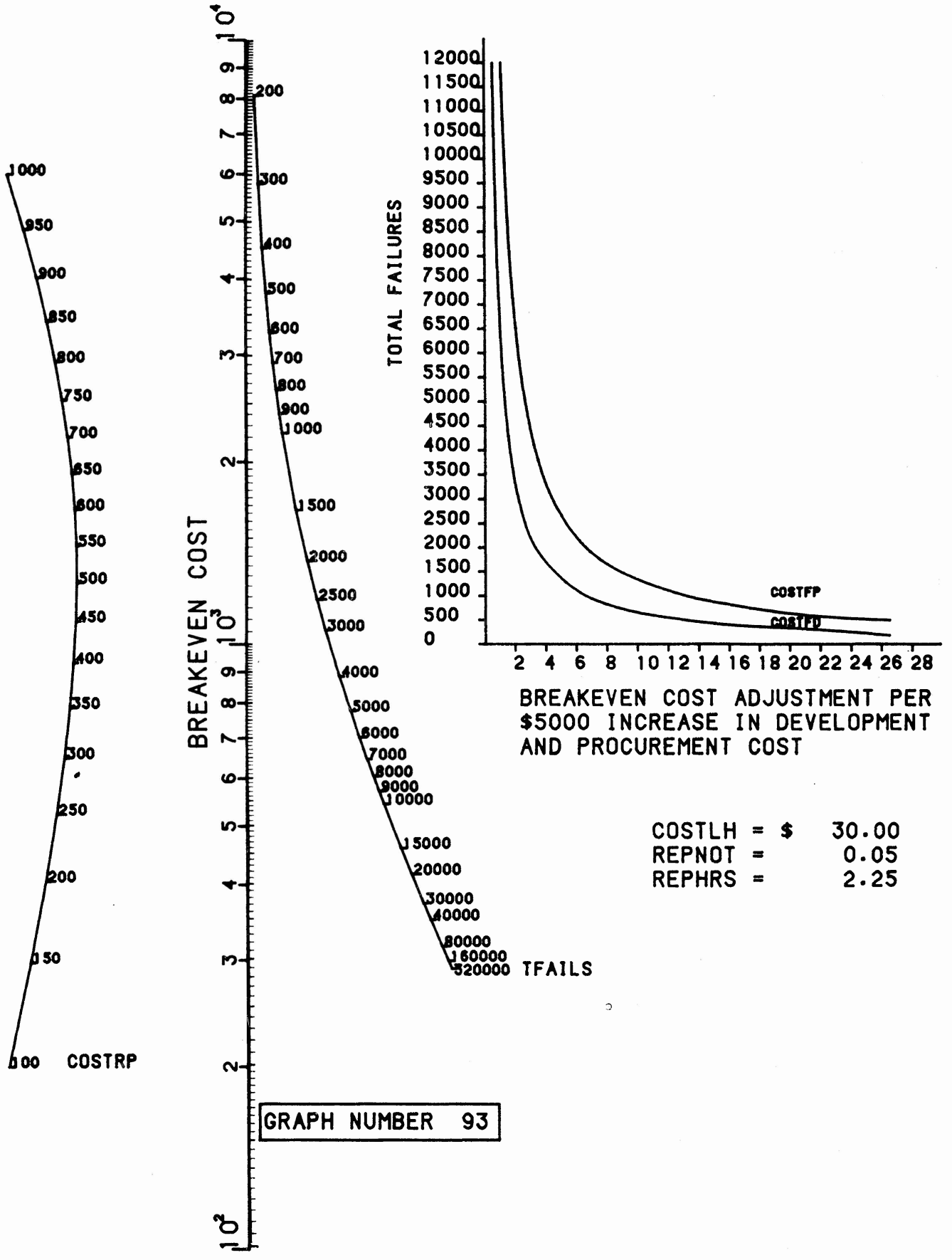
COSTLH = $ 30.00
REPNOT = 0.05
REPHRS = 2.00
GRAPH NUMBER 92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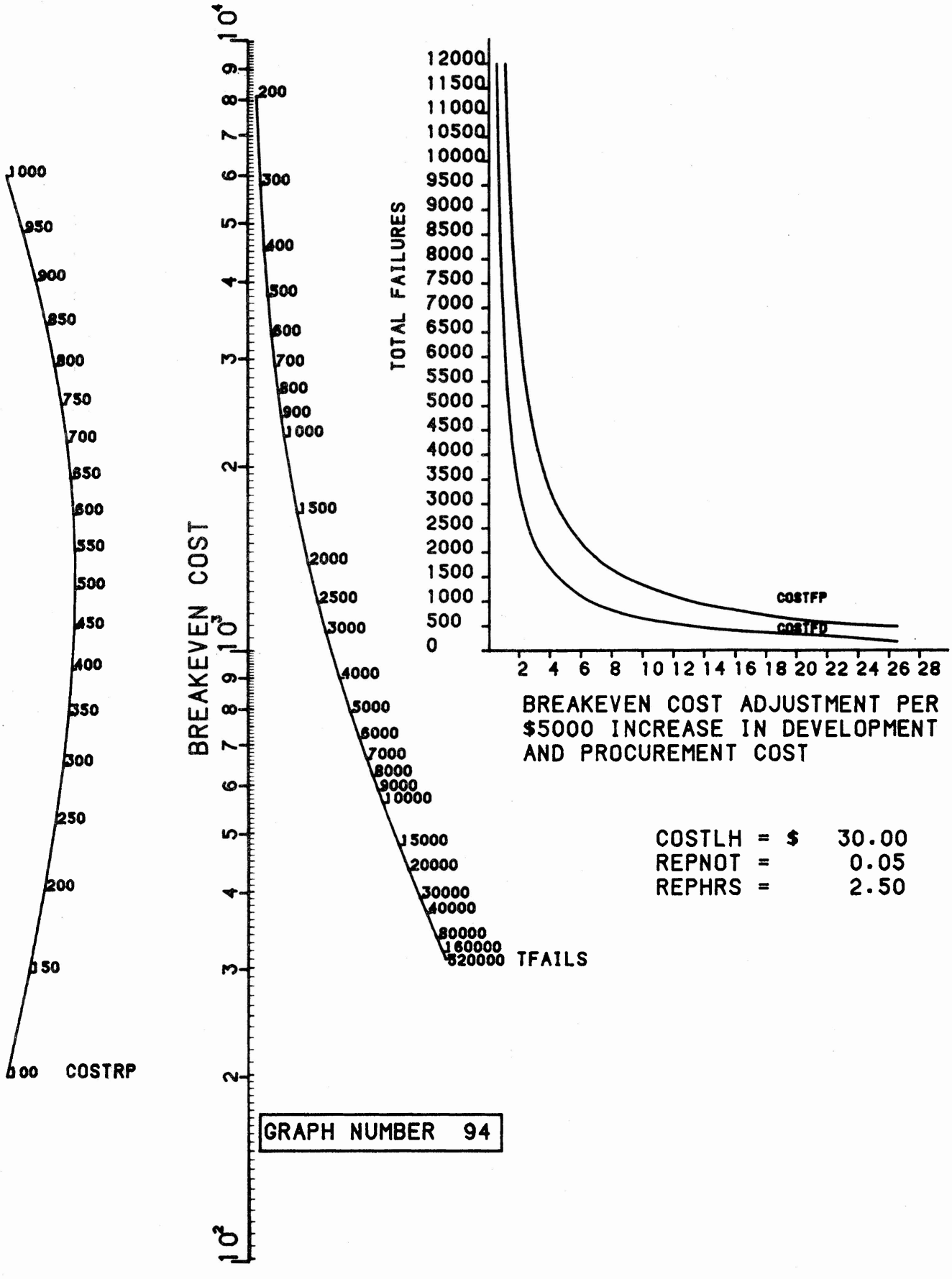
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.05
REPHRS = 2.25
GRAPH NUMBER 93


BREAKEVEN COST
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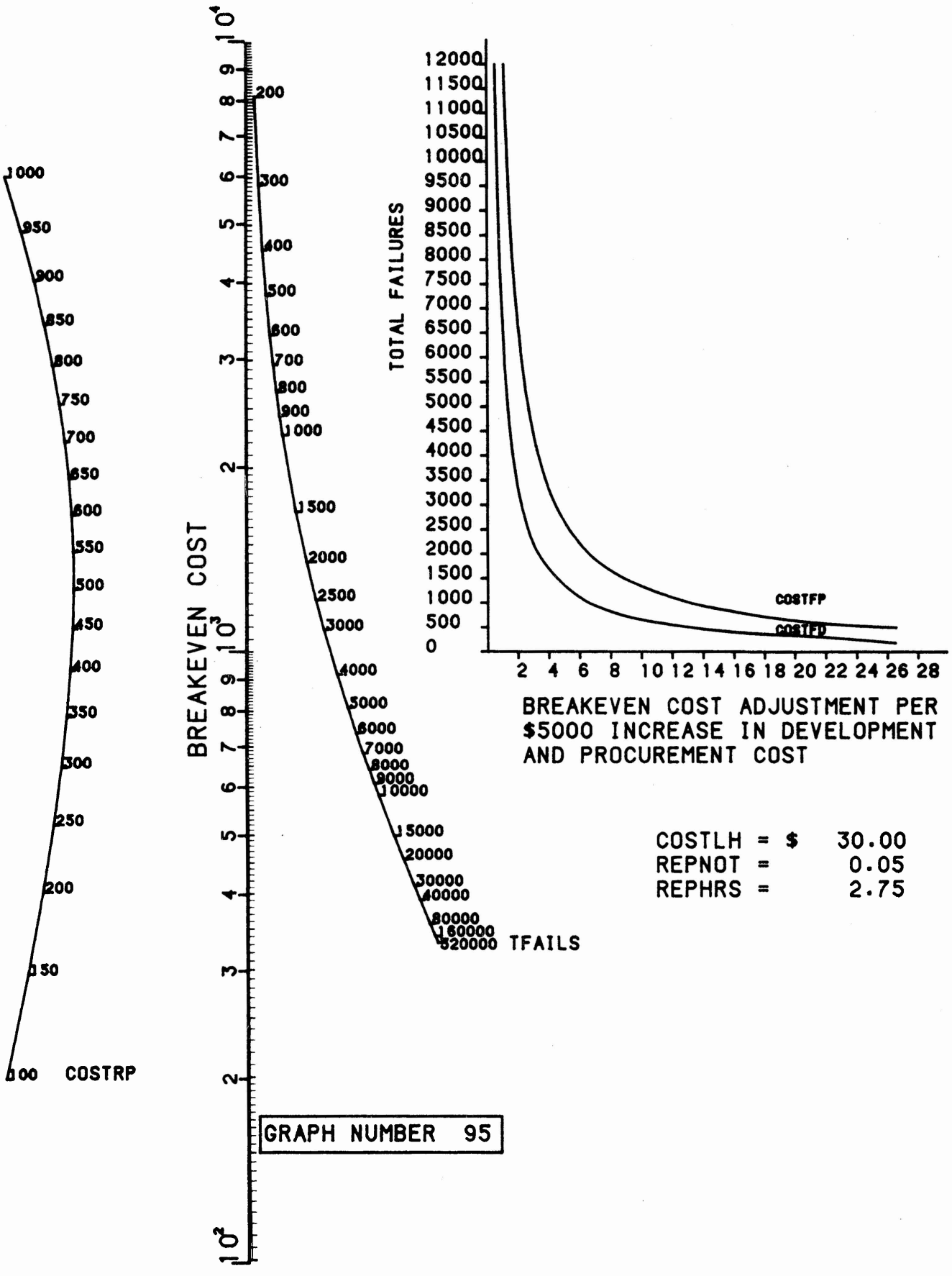
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.05
REPHRS = 2.50
GRAPH NUMBER 94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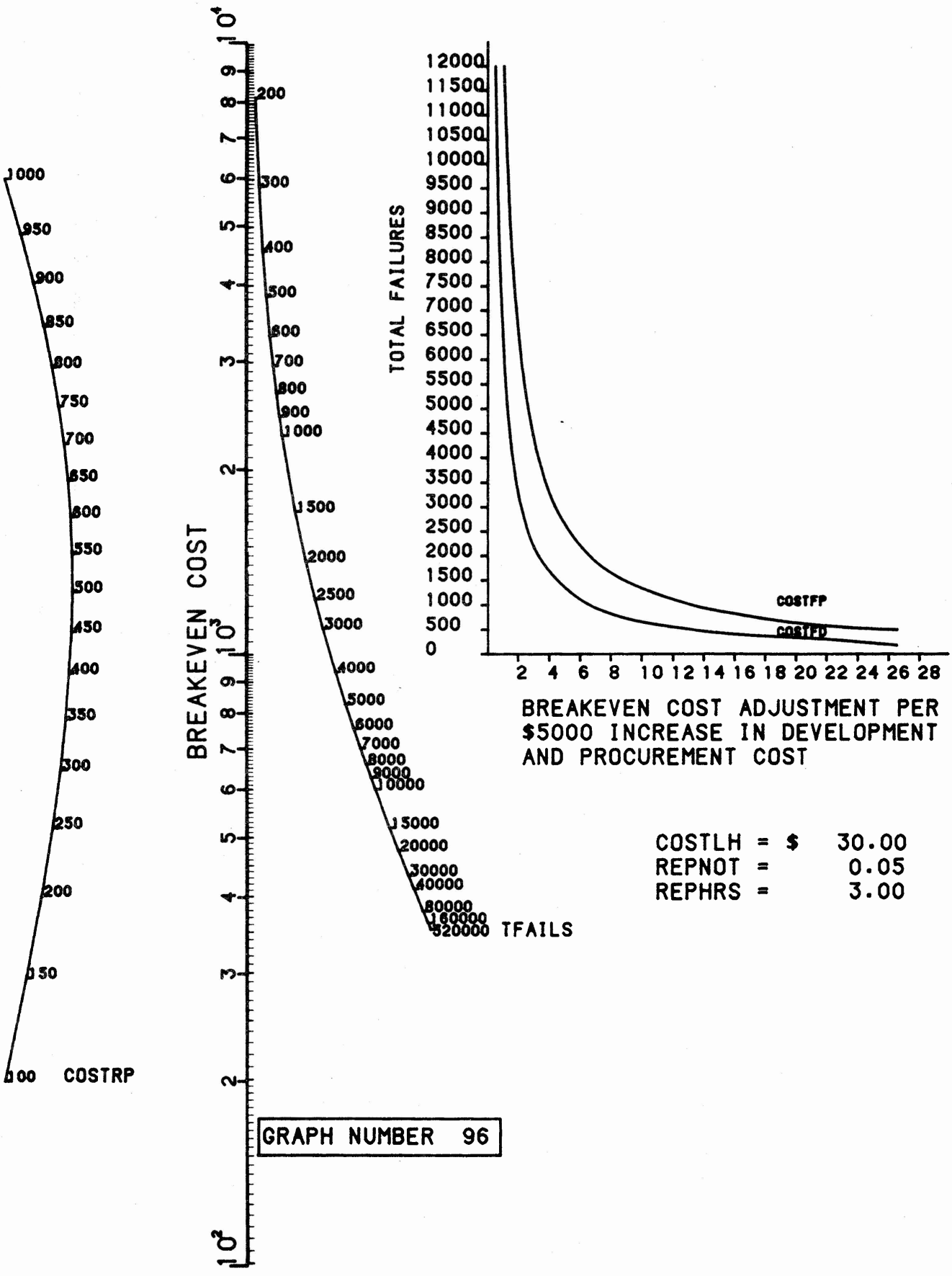
2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER $5000 INCREASE IN DEVELOPMENT AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.05
REPHRS = 2.75
GRAPH NUMBER 95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2 4 6 8 10 12 14 16 18 20 22 24 26 28
BREAKEVEN COST ADJUSTMENT PER
$5000 INCREASE IN DEVELOPMENT
AND PROCUREMENT COST
COSTLH = $ 30.00
REPNOT = 0.05
REPHRS = 3.00
GRAPH NUMBER 96

APPENDIX B

ASSUMPTIONS

For the less sensitive parameters that were involved in the development of this technique certain assumptions were necessary to keep the number of graphs limited to a managable level while covering as many situations as possible. The assumptions discussed below were chosen to reflect the most commonly encountered situations in the supply and maintenance systems. Generally, assumptions were made only for relatively insensitive parameters. The effects of varying the more sensitive of these parameters is also discussed.

Initial Provisions

Parameters:

Days to retrieve and replace a faulty assembly	5.0
Order and ship time from maintenance level to DX supply.	10.0
OST from depot supply to maint. level supply.	30.0
OST from factory to depot.	120.0
OST for non standard repair parts.	45.0
Turn around time (TAT) for attempted assembly repair	30.0
Safety stock coefficient	0.85

Effects:

Large variations in any of these parameters will have little effect on breakeven cost.

Supply

Parameters:

Cost to obtain an NSN	$648.00
Cost to maintain an NSN	$648.00
Requisition cost for repair parts	$18.64
Transportation and handling cost	$18.64
Administrative and engineering support	$3200.0
Cost to prepare a Special Quality Assurance Provision (SQUAP)	$559.00

Effects:

For holding cost between 10% and 20% there is virtually no effect on the breakeven cost. Requisition cost for spare parts and transportation cost also have little effect on the breakeven cost.

Initial and recurring NSN costs do not have a significant effect on breakeven cost. However, the number of NSN's does have a significant effect in many cases. The graphs in this guide assume that there are 20 unique NSN's. In cases which vary from this situation the breakeven cost will have to be adjusted by an amount determined by figure B-1.

Figure B-1 shows a dollar amount per NSN depending on the number of total failures. This dollar amount is multiplied by the difference between 20 and the number of NSN's and then added to the breakeven cost.

ex: Number of unique NSN's = 10
Number of failures =1000
From figure B-1, dollars per NSN = $26.00

10 - 20 = -10 --> -10 x 26 = -260

Breakeven cost = Breakeven cost + (-260)

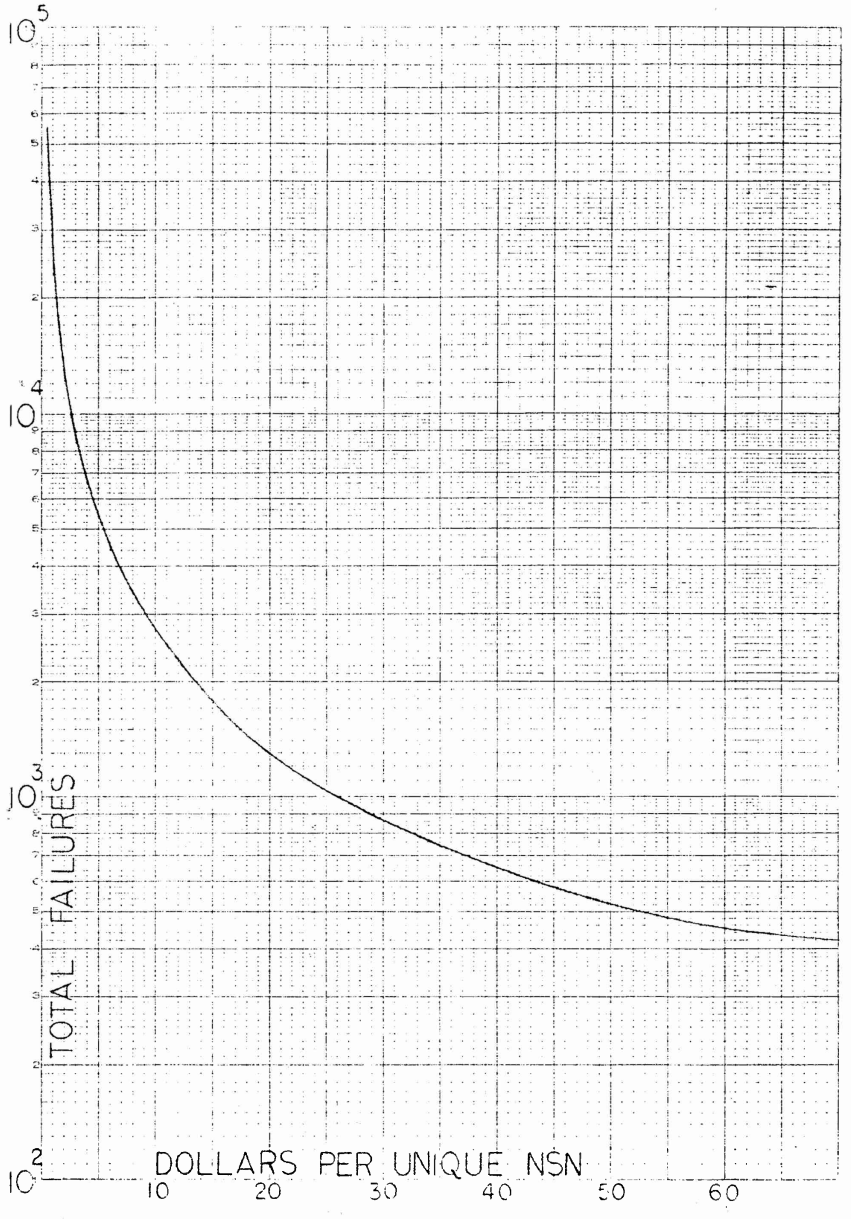

FIGURE B1 - UNIQUE PARTS COST

Test equipment and maintenance facilities

Parameters:

Maintenance facilities cost per hour.	$0.36
Test equipment and facilities development.	$0.00
Test equipment and facilities procurement.	$0.00
Facilities maintence cost as a percentage of procurement cost.	0.10

Effects:

The effects of development and procurement cost are adjusted by the user as described in the procedure section.

Personnel

Parameters:

Cost per labor hour	variable
Hours of training	40
Personnel trained per year	40

Effects:

Cost per labor hour is assumed to be $15/hr for forward repair. A survey of depots revealed that depot labor rates average about $30/hr and that most maintenance depots are within $2/hr of this cost.

Maintenance

Parameters:

Washout rate	variable
Percent of failed assemblies that return for repair	0.90
Number of tech pub pages above those required for throwaway.	100.
Cost per page for tech pubs	$550.00
MTTR	variable

Effects:

Washout rate and MTTR are controlled by the user. The cost per page for tech pubs averages $550.00, but, there is a wide variance in this figure between different systems. Even with this wide variance the breakeven cost remains fairly insensitive to this parameter.

End Item

Parameters:

Number of years of deployment	variable
Average cost of repair parts per repair	variable
End item deployment density	variable
Expected failures per million hours operation	variable
Number of assemblies per end item	variable
Number of new NSN's unique to this assembly	variable

Effects:

All of the above parameters are controlled by the user except for the number of NSN's. This parameter is discussed under the supply section.

APPENDIX C

DISTRIBUTION

COMMANDERS
AMC (AMCSM-PLD)
LOGC (ATCL-MRI)
(ATCL-OOA)
AMCCOM (SMCAR-MSM)
(AMSMC-LSA(D))
(AMSMC-LSO-C)
(AMSMC-RDA-S(R))
(AMSMC-LSC(A))
AVSCOM (AMSAV-LFS)
(AMSAV-BB)
BRDC (STRBE-DL)
NATICK (STRNC-E)
TROSCOM (AMSTR-CCT)
(AMSTR-LFS)
(AMSTR-LE)
(AMSTR-MP)
(AMSTR-LI)
EMRA (SELEM-ME-E)
CECOM (AMSEL-POD-SA)
(AMSEL-PL-E)
(AMSEL-SM-P-PL)
(AMSEL-ME-ME)
CSLA (SELCL-NMP-MM)
ERADCOM (AMDEL-PO-SA)
(AMDEL-IL)
MICOM (AMSMI-DS)
(AMSMI-HS)
(AMSMI-SL)
TACOM (AMSTA-MFS)
(AMSTA-HP)
(AMSTA-HC)
TECOM (AMSTE-AD-R)
CTA (AMXCT-SS)
DESCOM (AMSDS-SM-IT)
AMSAA (AMXSY-LX)
(AMXSY-FM)
(AMXSY-RV)
IRO (AMXSY-LIRO)
ARI (PERI-SM)
SSC (ATZI-NCM)
DA DCSOPS (DAIM-CF)
DA DCSLOG (DALO-SML)
AFLC (AFALC-XRS)
NAVAVCEN (213.2)
NALC (NALC-612D)
NAVAIR (AIR-41112A)

COMMANDANT, ALMC (AMXMC-ACM)
PROJECT/PROGRAM/PRODUCT MANAGERS
- SGT YORK (AMCPM-ADG-LR(R))
- MOBILE ELECTRIC POWER (AMCPM-MEP)
- AMPHIBIANS AND WATER CRAFT (AMCPM-AWP)
- TEST MEASUREMENT AND DIAGNOSTIC EQUIPMENT (AMCPM-TMDE-ASI)
- SINCGARS (AMCPM-GARS)
- BLACKHAWK (AMCPM-TND-SL)
- FIGHTING VEHICLE SYSTEM (AMCPM-FVS-LM)
- CANNON ARTILLERY WEAPON SYSTEM (AMCPM-CAWS-LM)